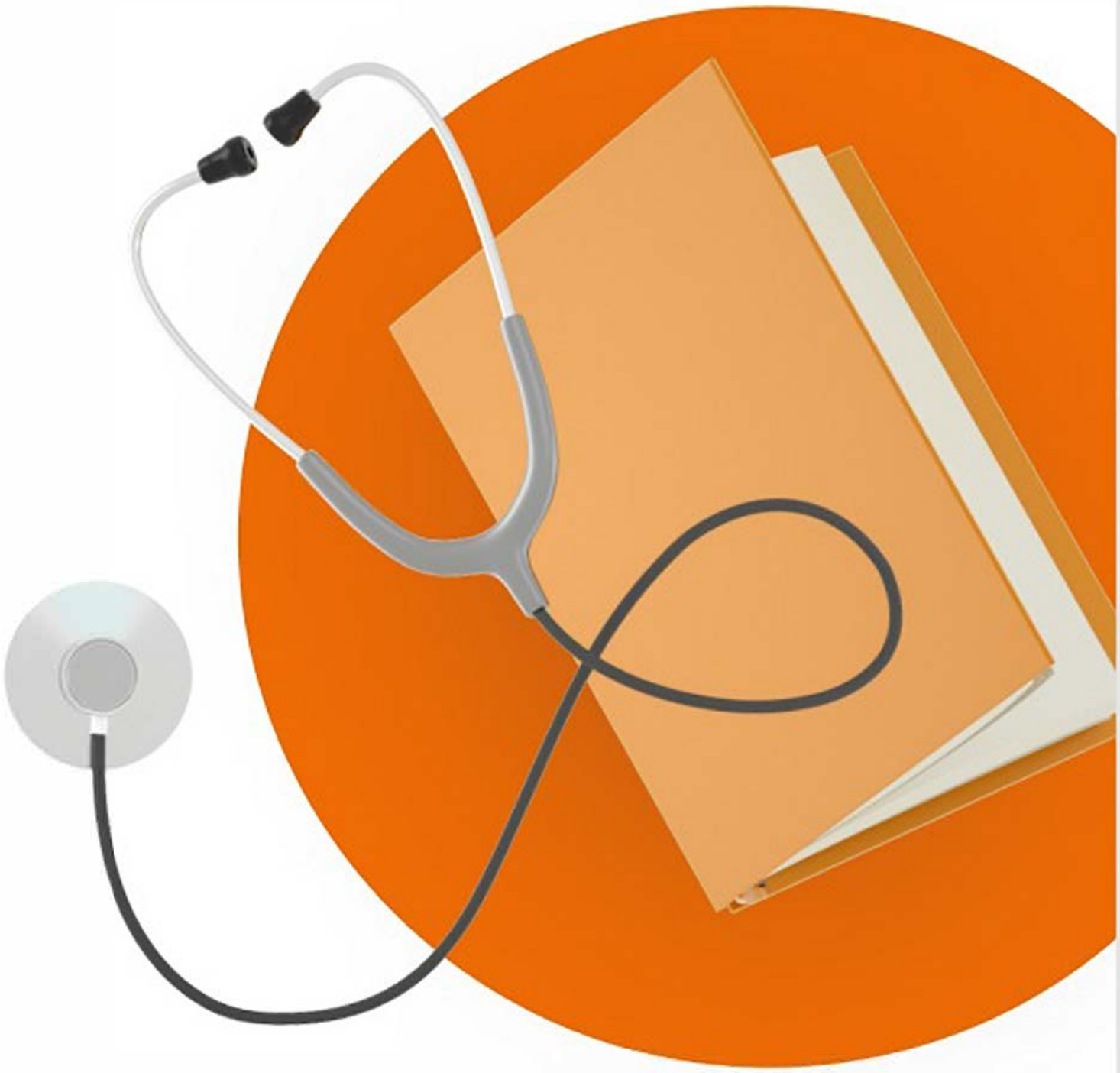
STRIDES in DEVELOPMENT of MEDICAL EDUCATION

Kerman University of Medical Sciences



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The Strides in Development of Medical Education Journal (SDME) is an Online Open Access, a free of charge and double-blind peer-reviewed with a continuous publication model journal. The aim of publishing the SDME is to promote the quality of education and inform via publishing research in all topics related to medical and health professions education. The SDME adopts a Platinum Open Access model, which entails no publication fees for the authors and also readers. Manuscripts are reviewed by at least 2 reviewers and the Editor-in-Chief. This journal provides reports of innovation and research such topics may include:

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Original Article

Students and Tutors' Perspectives on the Effectiveness of Online Problem-Based Learning in Medical and Health Professions

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Abstract

Background: The unprecedented COVID-19 pandemic has caused a sudden shift toward online learning, enabling students to continue learning from their homes.

Objectives: This study aimed to investigate students' and tutors' perspectives on the effectiveness of online problem-based learning (PBL) in medical and health professions.

Methods: A descriptive online survey was conducted on the PBL tutors and undergraduate students from the Schools of Dentistry, Medicine, and Veterinary Medicine. Two online questionnaires (one for students consisting of 23 items and one for PBL tutors comprising 24 items) were developed to capture respondents' perspectives on the effectiveness of online PBL in medical and health professional education during COVID-19 pandemic. Data were analyzed using percentage and Chi-square tests in SPSS V.26 software.

Results: A total of 485 students and 39 tutors completed the questionnaires. The majority of the students (77.1%, $p<0.01$) and tutors (89.8%, $p<0.01$) were comfortable using online PBL. They felt that it was easy to use Blackboard Collaborate through University's Learning Management System (myeLearning). However, 71.5% ($p<0.01$) of the students reported being distracted in online PBL classes due to connectivity issues.

Conclusion: The study indicated that both students and tutors generally found online PBL effective, successfully utilizing all features of Blackboard Collaborate during classes. However, students encountered connectivity issues and had difficulty sharing videos, images, and PowerPoint presentations. Continuous and thorough monitoring is essential to identify and resolve issues with the University's Learning Management System to enhance the delivery experience of online PBL.

Keywords: Learning Management System; Problem-Based Learning; COVID-19; Medical and Health Professionals; Online Learning

Background

In recent years, online teaching has emerged as a pivotal force in shaping the landscape of health professions education (1). The digital revolution has transformed traditional pedagogical approaches and become an indispensable component in preparing future healthcare professionals. In a systematic review and meta-analysis, it was found that face-to-face teaching and online teaching are equivalent to improving the learning outcomes of undergraduate medical students. The study suggested that online teaching has its advantages for students' learning and therefore it should be considered an important delivery mode in medical education (2). In a study on UK medical students' perception of the role of online teaching during COVID-19, it was found that students scored their experiences online compared with face-to-face teaching to be lower. However, students stated that online teaching allowed them to learn from home at their own pace (3). The effectiveness of online teaching depends on several factors, such as access to the internet, technological infrastructure, computer or any other supporting device, technical knowledge, student self-motivation, and a properly designed curriculum and lesson plan (4-6).

The Faculty of Medical Sciences at the University of the West Indies, St. Augustine comprises six major undergraduate disciplines: dentistry, medicine, nursing, optometry, pharmacy, and veterinary medicine, run through five Schools. The School of Medicine, Dentistry,

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and Veterinary Medicine each have 5-year undergraduate programs. In the first four semesters, the School of Medicine shares common courses where applicable with Dentistry and Veterinary Medicine utilizing a problem-based learning (PBL) delivery approach (7).

PBL is a student-centered approach in which students play a vital role in the entire learning process. A tutor is allocated for each PBL group who facilitates active learning, encourages critical thinking and promotes self-directed learning among students (8). Students volunteer to lead the group, and each member takes part actively in the brainstorming and discussion sessions (9). A PBL session lasts for approximately three hours in which a small group of students brainstorm a new problem, develop relevant hypotheses, generate learning objectives for self-study and construct new knowledge based on their prior knowledge (10).

The unprecedented COVID-19 pandemic has caused a sudden shift toward online PBL which enabled students to continue learning from their homes (11). During the survey, Blackboard Collaborate (BBC) through the official myeLearning online learning environment was used in the Faculty of Medical Sciences, St. Augustine, to conduct PBL and other didactic teaching sessions. The online PBL procedures implemented by the institution closely mirrored the traditional face-to-face PBL model employed prior to the onset of the COVID-19 pandemic.

Several studies have been conducted on students' and teachers' perspectives of online teaching in medical and health professions education (3, 12-15). In a survey of 33 students and 11 teachers from a dental school of the University of the West Indies, Trinidad and Tobago, students were similar to teachers' perceptions, as both were positive about online teaching during the COVID-19 pandemic. However, both groups expressed concerns about the clinical training through online delivery mode (16). In another study conducted at Lumbini Medical College, Nepal, two-thirds of the students (n=226) rated online classes to be poorer than the traditional classroom and when they were asked about their preferred mode of teaching in the future, 77.8% of them were in favor of traditional face-to-face teaching (17, 18). In the dental school of Justusl-Liebig-University, Germany, students stated that participation in online learning was easier compared to face-to-face teaching. Similar to students, most lecturers considered online teaching a good alternative during the unprecedented COVID-19 pandemic (15).

As highlighted above there is growing literature focused on the effectiveness of online learning in the healthcare training programme. However, studies rarely explore students' and tutors' perspectives of online PBL. Therefore, this study was designed to investigate students' and tutors' perspectives on the effectiveness of online PBL in medical and health professions during the COVID-19 pandemic.

Objectives

This study aimed to investigate students' and tutors' perspectives on the effectiveness of online problem-based learning (PBL) in medical and health professions.

Methods

Design and setting: A descriptive survey study was conducted at the Faculty of Medical Sciences, the University of the West Indies, St. Augustine Campus, Trinidad. The online survey was conducted on the PBL tutors and undergraduate students from the school of dentistry, medicine, and veterinary medicine. Ethical approval was obtained from the St Augustine Campus Research Ethics Committee of the University of the West Indies with the reference numbers Ref: CREC-SA.0536/10/2020.

Participants: The online questionnaires on Google Forms were sent to the students and PBL tutors via emails between 15th November and 23rd December 2020. Students from schools of medicine (years 1-3), dentistry (years 1 & 2), and veterinary medicine (year 1) in the Faculty of Medical Sciences at the University of the West Indies, who studied the basic health science courses through online PBL, as well as all PBL tutors, were included in the study. The sample size was calculated using the formula $n = N/(1 + N * e^2)$, where n: The sample size to be determined, N: The total population size and e: The margin of error (1. Using the formula, with a population of 853 students with a 95% confidence interval and a 5% margin of error, the sample size needed for the study was at least 272 students, and we considered 485 students for the present study. Furthermore, for a population of 43 tutors with a 95% confidence interval, we considered collecting data from at least 39 individuals to ensure the results were statistically significant.

The participants were fully informed about the objective of the study. Participation in the study was voluntary, and there was no penalty if they declined to participate. To minimize the possibility of non-response bias, three email reminders were sent to the participants.

Only fully completed questionnaires were included in the data analysis.

Measures: Two online questionnaires (one for students and one for PBL tutors) were developed deriving ideas from related literature. Both the questionnaires aimed to capture the following three areas: The first part of the questionnaire collected data on the demographic details of respondents (Students: gender, age, nationality and device used during PBL; Tutors: gender, year of experience as PBL tutor, nature of appointment and device used during PBL). In the second part, questionnaires on respondents' perspectives on the effectiveness of online PBL in Medical and Health Professions during the COVID-19 pandemic. The questionnaires consist of 23 items for students and 24 items for PBL tutors which cover respondents' perceptions on the use of technology, comfortableness of learning from home, tutor's role, teamwork, and communication skills in virtual PBL. The questionnaires were rated on a 4-point Likert scale ranging from 1 = strongly disagree to 4 = strongly agree. In the third part, responses for two open-ended items were collected and underwent thematic analysis whereby responses were categorized. The content validity of the instruments for both students and tutors was measured based on the feedback of five experts, all experienced PBL tutors. The experts' recommendations were incorporated to ensure grammatical accuracy, correct word usage and proper word order in items. Additionally, two items were discarded from the student version of the questionnaire based on their suggestions. Cronbach's Alpha showed acceptable reliability of the questionnaires for students (α=0.91) and tutors (α=0.89).

Data Analysis: Data were analysed using Statistical Package for the Social Sciences (SPSS), version 26. The internal consistency of the questionnaires was measured by Cronbach's Alpha. Descriptive statistics were used to summarize the demographic characteristics of the participants. Percentage and Chi-square tests were used to see whether the distribution of frequencies of responses in each item was significantly different. A p-value of less than 0.05 was considered statistically significant. The responses collected from two open-ended items were collated and presented thematically.

Results

Students' perspective on the effectiveness of Online PBL

Of the total 853 students, 485 completed the questionnaires, resulting in a response rate of 56.86%. Among these respondents, 25.10% were male, 74.90% were female, and 0.62% preferred not to say. Students aged below 21 years (46.80%) and between 21 and 22 years (34.85%) accounted for the majority of the sample. Concerning nationality, most of the students were from Trinidad and Tobago (88.69%). Additionally, the majority of the students (88.07%) used a laptop, tablet, and mobile phone (Table 1).

Table 2 shows the questionnaire items on students' perspectives of online PBL, including the Chi-square p-value and percentage of responses for each item.

Regarding technical aspects, more than two-thirds of students (77.1%, $p<0.01$) found it easy to adapt to online PBL. However, most of them (71.5%, $p<0.01$) reported that they got distracted in online PBL classes due to connectivity issues. More than half of the students (52.4%, $p<0.01$) stated that their groups had some difficulties sharing videos, images, and PowerPoint presentations.

Students believed that online PBL allowed them to work collaboratively as a team. This explains why the majority of the students (73.6%, $p<0.01$) agreed that online PBL helped members of the PBL group to work as a team. The majority of the students (78.7%, $p<0.01$) felt they had the opportunity to express their ideas in their own words. However, 63.1% ($p<0.01$) of the students reported that online PBL made the less participatory students more passive. Additionally, 85.2% ($p<0.01$) of the students stated that they learned to search for reliable learning resources through online PBL. Furthermore, students were highly satisfied with the tutors' role in the virtual PBL mode. They believed that most of the tutors created a supportive and comfortable learning environment. The majority of the students (78.7%, $p<0.01$) agreed to recommend the continued use of online strategies in the teaching of PBL. Table 2 shows that Chi-square values for all the items were found to be statistically significant.

Tutors' perspective on the effectiveness of online PBL

Out of 43 tutors, a total of 39 completed the questionnaire, representing a response rate of 90.70%. Among these tutors, 56.42% were male and 43.59% were female. Of the total, 48.72% of the tutors had 5 years or less of experience as PBL tutors, and 56.4% were full-time faculty members. The majority of them (71.79%) used laptops, tablets, or mobile phones during PBL sessions (Table 1).

Table 3 represents the questionnaire items regarding tutors' perceptions of the effectiveness of online PBL, including Chi-square p-value and the percentage of responses for each item. Most of the tutors (94.9%, $p<0.01$) found it easy to use BBC through the University's

Learning Management System (LMS), i.e., my eLearning. Furthermore, 84.6% ($p<0.01$) of the tutors found their environment conducive to delivering online PBL.

Nearly half of the tutors (51.3%, $p<0.01$) agreed that online PBL was as effective as face-to-face communication for conveying information orally.

However, 48.7% ($p=0.049$) of tutors agreed that it was difficult to keep track of students' participation since they could not see their faces during the virtual classes.

Almost all the tutors agreed that students had the opportunity to generate issues, hypotheses, and objectives through online PBL classes. However, most of them (76.9%, $p<0.01$) did not agree with the statement that online PBL is more effective in improving the critical thinking and reasoning skills of the students than face-to-face sessions. The majority of the tutors (74.4%, $p=0.023$) stated that they did not have any challenges filling out the online PBL Assessment Rating Scale. Despite a few challenges, 79.5% ($p<0.01$) of the tutors were in favor of online PBL and were happy to recommend it for undergraduate medical and health professions students. Table 3 summarizes that the Chi-square values for all the items are found to be statistically significant except for one item: "Online PBL increased opportunities for quiet students to talk in audio mode."

Advantages of Online PBL

There were two open-ended questions in the questionnaires, such as (a) List the challenges of Online PBL sessions and (b) List the benefits of Online PBL sessions. Using MS Excel spreadsheets, we initially created codes to capture key aspects of the data, such as "technical challenges", "technical proficiency", "engagement", "teamwork", 'peer interaction", "communication", "feedback", time management, "connectivity", "convenient", and "distraction". We then used another sheet to group similar codes into three overarching themes for both advantages and disadvantages, ensuring these themes accurately reflected the data. Here are some of the advantages identified by the students and the tutors:

Time Management: The students expressed their satisfaction with the online environment which allowed them to continue studying at home without any stress and anxiety. Both students and tutors were happy with the time taken to do the online PBL. The main advantages of online PBL appeared to be that it saved traveling time, it was more comfortable, and it made the students punctual. One of the students stated: "It is less stressful to wake up half an hour before a class then attend it than having to spend hours in traffic before reaching school on time (The extra sleep is appreciated) and personally, I think the process is a bit more relaxed when you are in the comfort of your own home."

Students' participation: The online PBL sessions ran smoothly, and participation increased greatly, especially from quieter students. It promoted teamwork and collaboration even with the lack of physical interaction. This is made evident from the following statement. "I felt more comfortable to speak. I have a soft voice, so people tend not to hear me so much in person... now people hear my voice a lot more clearly. I love the chat option. Many times, I find I express my thoughts better putting them into words and it is easier to see and remember and retain what everyone is saying. You can also copy and paste from the chat into the Google doc directly."

Convenient and Effective: The students and tutors universally acknowledged that the introduction of online PBL was a commendable initiative amid the challenges posed by the pandemic, allowing for the uninterrupted continuation of academic pursuits. Despite encountering initial hurdles in navigating the online platform, both students and tutors demonstrated remarkable adaptability, swiftly embracing the virtual learning process. The statement in favor of online PBL included the following: "I found it convenient and easy to speak as we got the opportunity to raise hands when we wanted to talk. Easy to handle the hardware and software. It was a less intimidating process which I believed aided the overall learning experience."

Barriers to effective online PBL

The absence of physical presence posed challenges to the nuanced dynamics of face-to-face communication and collaboration, elements that are integral to the traditional PBL experience. Despite this acknowledgment, both students and tutors emphasized the imperative to embrace online PBL as a pragmatic and essential measure during the unprecedented circumstances brought about by the pandemic. Here are some of the challenges of online PBL.

Technical Challenges: Some of the common technical problems were occasional connectivity issues, occasional malfunctioning of BBC, microphone problems and occasional power failure in some areas. Some participants had problems logging into myeLearning. The following statement revealed the challenges: "We experienced difficulties entering the myeLearning platform during peak hours and connection was dropping during the PBL session. There were audio issues as well and some students constantly had to refresh the page."

Distraction to PBL: Apart from technical difficulties, there were also too many distractions in the PBL delivery process. Students talking over each other, not hearing the persons during their presentations, family members talking during presentations, anxiety to present at home, and external sounds were some of the challenges of online PBL. The statement reflecting the distraction to PBL included the following: "Sometimes some members have mic issues, or connectivity issues, which prevent them from contributing as much as they would like to. I also find it difficult to continuously stare at my screen for such a period of time. Sometimes there is also unavoidable noise in my surroundings and I have to limit my mic use because of it."

Lack of Monitoring: In a virtual learning environment where cameras were either turned off for all participants or only the speaker's camera was active, tutors faced a considerable challenge in gauging whether students were actively engaged in the discussion or simply reading from their screens. This is made evident from the following statement given by a tutor: "It is difficult for me to assess when the student exits the class if it is genuine. It is hard to know if all are actively participating at all times due to visual turned off (from overload). With Audio only it is difficult when presenting the objectives if students are reading the information."

Discussion

The present study investigated students' and tutors' perspectives on the effectiveness of online PBL in medical and health professions during COVID-19 pandemic. The swift transition to online learning posed initial challenges for both students and tutors. However, as time progressed, both groups found it increasingly manageable to adopt online PBL through the use of the BBC platform. Consistent with earlier studies, the current findings underscore the favorable perceptions and receptiveness exhibited by both tutors and learners in the context of online instruction (15, 19, 20). However, the results are in contrast with the studies conducted in Jordan and Uganda where the majority of medical students had negative attitudes toward online teaching (14, 21).

The outcomes of our study indicate that virtual PBL was a suitable and convenient delivery mode because tutors and students did not have to travel during the lockdown, and they comfortably took part in the learning activities from different geographical locations. In response to the open-ended question of our study, some students expressed satisfaction with studying virtually from home, noting their enhanced ability to concentrate fully. These findings are consistent with previous studies, wherein the participants preferred virtual learning mode for reasons of convenience and reduced costs (22, 23).

The findings of our study revealed that students exhibited a highly positive attitude toward the performance of tutors in online PBL. They agreed that tutors were very supportive, created a comfortable learning environment, encouraged students to actively participate in the PBL process, and provided constructive and timely feedback. Prior research has similarly affirmed the pivotal role played by tutors in students' learning and the overall effectiveness of PBL (24, 25).

The present study revealed that online PBL allowed students to work collaboratively as a team, enhanced their critical thinking skills, and facilitated the creation of new knowledge. In a study conducted at the College of Medicine, Qassim University, Saudi Arabia, it was found that online PBL enhanced collaborative learning and critical thinking (26). In contrast, our tutors believed that face-to-face PBL sessions were more effective in improving the critical thinking and reasoning skills of the students than online sessions. Tutors' preference for in-person PBL may stem from their ability to engage in both verbal and nonverbal communication with students. In this setting, tutors can interact with each group member individually, free from distractions.

In the present study, students engaged in online PBL demonstrated effective communication by expressing diverse ideas in their own words and actively participating in group discussions. However, in a previous study, it was found difficult to communicate either with instructors or with peer students in doing distance learning (12). In our study, the number of students in each PBL group was between 12 to 15 and duration of teaching was three hours. Since interaction and discussion were integral parts of PBL, each student had time and opportunity to take part in the PBL process.

In addition to its clear benefits, online PBL introduces certain drawbacks. Connectivity issues, distractions from external noise, voice interruptions caused by poor audio quality, occasional malfunctions of the BBC platform, and the absence of nonverbal communication emerged as notable barriers that must be addressed to ensure the effective implementation of online PBL. These challenges align with findings from other studies where students encountered various difficulties, including poor connectivity, technical

issues, and external disturbances during online teaching (12, 27, 28). Coiada et al., 2020 indicated that students in online PBL were at a higher risk of distraction due to increased screen time and access; thus, the tutor must play a significant role in keeping the students engaged and focused on the learning process (26). In spite of these challenges, both students and tutors expressed satisfaction and were enthusiastic about recommending the continued use of online PBL.

The limitations of the present study include the generalizability of the study by the use of data from a single institution. Another limitation is that our study covered a short period, which did not allow for long-term effects to be assessed. We could not measure educational outcomes linked to online PBL and did not compare them to face-to-face PBL.

Conclusion

The study indicated that both students and tutors generally found online PBL effective, successfully utilizing all features of Blackboard Collaborate during classes and engaging themselves actively in the online sessions. However, students encountered connectivity issues and had difficulty sharing videos, images, and PowerPoint presentations. Continuous and thorough monitoring is essential to identify and resolve various issues within the online learning process, particularly those related to the University's Learning Management System, to enhance the delivery experience of online PBL. Additionally, further research is needed to thoroughly evaluate student performance in online PBL settings

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References

1. Luyben A, Fleming V, Vermeulen J. Midwifery education in COVID-19- time: Challenges and opportunities. Midwifery. 2020 Oct:89: 102776. doi: 10.1016/j.midw.2020.102776. [PMID: 32526596] [PMCID: PMC7263260]
2. Pei L, Wu H. Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis. Med Educ Online. 2019 Dec;24(1):1666538. doi: 10.1080/10872981.2019.1666538. [PMID: 31526248] [PMCID: PMC6758693]
3. Dost S, Hossain A, Shehab M, Abdelwahed A, Al-Nusair L. Perceptions of medical students towards online teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students. BMJ Open. 2020 Nov 5;10(11):e042378. doi: 10.1136/bmjopen-2020-042378. [PMID: 33154063] [PMCID: PMC7646323]
4. O'Doherty D, Dromey M, Lougheed J, Hannigan A, Last J, McGrath D. Barriers and solutions to online learning in medical education - an integrative review. BMC Med Educ. 2018 Jun 7;18(1):130. doi: 10.1186/s12909-018-1240-0. [PMID: 29880045] [PMCID: PMC5992716]
5. Sahu P. Closure of Universities Due to Coronavirus Disease 2019 (COVID-19): Impact on Education and Mental Health of Students and Academic Staff. Cureus. 2020 Apr 4;12(4):e7541. doi: 10.7759/cureus.7541. [PMID: 32377489] [PMCID: PMC7198094]
6. Shawaqfeh MS, Al Bekairy AM, Al-Azayzih A, Alkatheri AA, Qandil AM, Obaidat A A, et al. Pharmacy Students Perceptions of Their Distance Online Learning Experience During the COVID-19 Pandemic: A Cross-Sectional Survey Study. J Med Educ Curric Dev. 2020 Oct 6:7:2382120520963039. doi: 10.1177/2382120520963039. [PMID: 33088916] [PMCID: PMC7543106]
7. UWI. Undergraduate regulations & syllabuses 2020/2021, the Faculty of Medical Sciences. Trinidad & Tobago: The University of the West Indies, St. Augustine Campus; 2021.
8. Sa B, Ezenwaka C, Singh K, Vuma S, Majumder MAA. Tutor assessment of PBL process: does tutor variability affect objectivity and reliability?. BMC Med Educ. 2019 Mar 8;19(1):76. doi: 10.1186/s12909-019-1508-z. [PMID: 30850024] [PMCID: PMC6407196]
9. Sahu PK, Nayak S, Rodrigues V. Medical students' perceptions of small group teaching effectiveness in hybrid curriculum. J Educ Health Promot. 2018 Feb 9:7:30. doi: 10.4103/jehp.jehp_71_17. [PMID: 29629391] [PMCID: PMC5852982]
10. Addae JI, Sahu P, Sa B. The relationship between the monitored performance of tutors and students at PBL tutorials and the marked hypotheses generated by students in a hybrid curriculum. Med Educ Online. 2017;22(1):1270626. doi: 10.1080/10872981.2017.1270626. [PMID: 28178915] [PMCID: PMC5328341]
11. Ng YM, Or PLP. Coronavirus disease (COVID-19) prevention: Virtual classroom education for hand hygiene. Nurse Educ Pract. 2020 May:45:102782. doi: 10.1016/j.nepr.2020.102782. [PMID: 32388117] [PMCID: PMC7252133]
12. Amir LR, Tanti I, Maharani DA, Wimardhani YS, Julia, V, Sulijaya B, et al. Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program Universitas Indonesia. BMC Med Educ. 2020 Oct 29;20(1):392. doi: 10.1186/s12909-020-02312-0. [PMID: 33121488] [PMCID: PMC7594975]
13. Frazer C, Sullivan DH, Weatherspoon D, Hussey L. Faculty Perceptions of Online Teaching Effectiveness and Indicators of Quality. Nurs Res Pract. 2017: 2017: 9374189. doi: 10.1155/2017/9374189. [PMID: 28326195] [PMCID: PMC5343272]
14. Olum R, Atulinda L, Kigozi E, Nassozi DR, Mulekwa A, Bongomin F, et al. Medical Education and E-Learning During COVID-19 Pandemic: Awareness, Attitudes, Preferences, and Barriers Among Undergraduate Medicine and Nursing Students at Makerere University, Uganda. J Med Educ Curric Dev. 2020 Nov 19:7:2382120520973212. doi: 10.1177/2382120520973212. [PMID: 33283049] [PMCID: PMC7682244]

15. Schlenz MA, Schmidt A, Wöstmann B, Krämer N, Schulz-Weidner N. Students' and lecturers' perspective on the implementation of online learning in dental education due to SARS-CoV-2 (COVID-19): a cross-sectional study. BMC Med Educ. 2020 Oct 9;20(1):354. doi: 10.1186/s12909-020-02266-3. [PMID: 33036592] [PMCID: PMC7545382]
16. Rafeek R, Sa B, Harnarayan P, Farnon N, Singh S, Giddings S, et al. Effectiveness of Rapid transition to online teaching during COVID 19: An online cross-sectional survey of students' and teachers' perceptions in a West Indian Dental School. Creative Education. 2021; 12(6):1222-34. doi: 10.4236/ce.2021.126092.
17. Nepal S, Atreya A, Menezes RG, Joshi RR. Students' Perspective on Online Medical Education Amidst the COVID-19 Pandemic in Nepal. J Nepal Health Res Counc. 2020 Nov 14; 18(3):551-5. doi: 10.33314/jnhrc.v18i3.2851. [PMID: 33210658]
18. Yamane T. Statistics: An Introductory Analysis, 2nd Ed. New York: Harper and Row; 1967.
19. Alkhowailed MS, Rasheed Z, Shariq A, Elzainy A, El Sadik A, Alkhamiss A. Digitalization plan in medical education during COVID-19 lockdown. Inform Med Unlocked. 2020:20:100432. doi: 10.1016/j.imu.2020.100432. [PMID: 32959020] [PMCID: PMC7494503]
20. Shimizu I, Nakazawa H, Sato Y, Wolfhagen IHAP, Könings KD. Does blended problem-based learning make Asian medical students active learners?: a prospective comparative study. BMC Med Educ. 2019 May 15;19(1):147. doi: 10.1186/s12909-019-1575-1. [PMID: 31092243] [PMCID: PMC6521359]
21. Al-Balas M, Al-Balas HI, Jaber HM, Obeidat K, Al-Balas H, Aborajooh EA. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. BMC Med Educ. 2020 Oct 2;20(1):341. doi: 10.1186/s12909-020-02257-4. [PMID: 33008392] [PMCID: PMC7530879]
22. Riaz A, Khan RA, Arooj M, Iqbal MZ. Exploring the viability of online problem-based learning through the lens of students and teachers. Education in Medicine Journal. 2021;13(4):19-31. doi:10.21315/eimj2021.13.4.2.
23. Xie H, Wang L, Pang Z, Chen S, Xu G, Wang S. Application of problem-based learning combined with a virtual simulation training platform in clinical biochemistry teaching during the COVID-19 pandemic. Front Med (Lausanne). Front Med (Lausanne). 2022 Oct 26:9:985128. doi: 10.3389/fmed.2022.985128. [PMID: 36388919] [PMCID: PMC9644193]
24. Coiado OC, Yodh J, Galvez R, Ahmad K. How COVID-19 transformed problem-based learning at Carle Illinois College of Medicine. Med Sci Educ. 2020 Aug 24;30(4):1353-4. doi: 10.1007/s40670-020-01063-3. [PMID: 32864181] [PMCID: PMC7444895]
25. Luo P, Pang W, Wang Y, Liu M, Zhou S, Liu S. WeChat as a Platform for Problem-Based Learning Among Hematological Postgraduates: Feasibility and Acceptability Study. J Med Internet Res. 2021 May 25;23(5):e16463. doi: 10.2196/16463. [PMID: 34032573] [PMCID: PMC8188312]
26. Elzainy A, El Sadik A, Al Abdulmonem W. Experience of e-learning and online assessment during the COVID-19 pandemic at the College of Medicine, Qassim University. J Taibah Univ Med Sci. 2020 Dec;15(6):456-462. doi: 10.1016/j.jtumed.2020.09.005. [PMID: 33106752] [PMCID: PMC7578775]
27. Bączek M, Zagańczyk-Bączek M, Szpringer M, Jaroszyński A, Wożakowska-Kapłon B. Students' perception of online learning during the COVID-19 pandemic: A survey study of Polish medical students. Medicine (Baltimore). 2021 Feb 19; 100(7):e24821. doi: 10.1097/MD.0000000000024821. [PMID: 33607848] [PMCID: PMC7899848]
28. Tuma F, Nassar A K, Kamel MK, Knowlton LM, Jawad NK. Students and faculty perception of distance medical education outcomes in resource-constrained system during COVID-19 pandemic. A cross-sectional study. Ann Med Surg (Lond). 2021 Jan 25:62:377-382. doi: 10.1016/j.amsu.2021.01.073. [PMID: 33552498] [PMCID: PMC7848719]

Table 1. Distribution of the participants' profile

Participants	Variables	Categories	Frequency	Percentage
Students	Gender	Male	121	25.10
		Female	361	74.90
	Age group	< 21	227	46.80
		21-22	169	34.85
		23 & above	89	18.35
	Nationality	Trinidad and Tobago	435	89.69
		Others	50	10.31
	Devices used for online PBL classes	Laptop, Tablet and Mobile	432	89.07
		Desktop	53	10.93
Tutors	Gender	Male	22	56.41
		Female	17	43.59
	Years of experience as PBL tutor	5 years and below	19	48.72
		6-10	6	15.38
		11 and above	14	35.90
	Nature of appointment	Full time	22	56.41
		Part time	17	43.59
	Devices used for online PBL classes	Laptop, tablet, mobile	28	71.79
		Desktop	11	28.21

Table 2. Students' perspective of the effectiveness of online PBL (n = 485): Values in parentheses indicate percentages

Dimensions	Items	Strongly Disagree	Disagree	Agree	Strongly Agree	P-value
Technical Aspect	I found it easy to adapt online PBL.	14 (2.9)	97 (20)	263 (54.2)	111 (22.9)	<0.001
	I was able to use all the features of BBC properly to make my online PBL better.	16 (3.3)	99 (20.4)	261 (53.8)	109 (22.5)	<0.001
	I got distracted in online PBL classes due to an internet connectivity issue.	45 (9.3)	93 (19.2)	181 (37.3)	166 (34.2)	<0.001
	Our group had some difficulties sharing the videos, images, and power points.	53 (10.9)	178 (36.7)	174 (35.9)	80 (16.5)	<0.001
Learning environment and teamwork	I had a dedicated space and required devices to learn from home.	21 (4.3)	63 (13)	219 (45.2)	182 (37.5)	<0.001
	It helped members of the PBL group to work as a team	24 (4.9)	104 (21.4)	243 (50.1)	114 (23.5)	<0.001
	It enhanced commitment to the group task	32 (6.6)	135 (27.8)	219 (45.2)	99 (20.4)	<0.001
	The duration of the online PBL session was enough to get the benefits that I needed.	26 (5.4)	82 (16.9)	269 (55.5)	108 (22.3)	<0.001
Communication and participation	In online PBL, it was easy to communicate information orally in a clear manner.	46 (9.5)	130 (26.8)	217 (44.7)	92 (19)	<0.001
	We got an opportunity to express our ideas in our own words.	12 (2.5)	77 (15.9)	285 (55.8)	111 (22.9)	<0.001
	Online PBL made the less participatory students more passive.	35 (7.2)	144 (29.7)	180 (37.1)	126 (26)	<0.001
	It facilitated active participation in the PBL group discussion within and outside of the PBL session.	30 (6.2)	126 (26)	236 (48.7)	93 (19.2)	<0.001
	It helped me to lead the group in PBL sessions.	26 (5.4)	151 (31.1)	220 (45.4)	88 (18.1)	<0.001
Self-directed learning	Online PBL improved my critical thinking and reasoning skills.	30 (6.2)	101 (20.8)	238 (49.1)	116 (23.9)	<0.001
	It helped me integrate prior knowledge when generating issues.	19 (3.9)	79 (16.3)	271 (55.9)	116 (23.9)	<0.001
	I got an opportunity to formulate clear learning objectives.	15 (3.1)	58 (12)	290 (59.8)	122 (25.2)	<0.001
	I learned to search for reliable learning resources through online PBL.	15 (3.1)	57 (11.8)	273 (56.3)	140 (28.9)	<0.001
Role of the tutor	The tutor had the good technical knowledge to run online PBL.	13 (2.7)	52 (10.7)	230 (47.4)	190 (39.2)	<0.001
	The tutor created a supportive and comfortable learning environment.	20 (4.1)	48 (9.9)	223 (46)	194 (40)	<0.001
	The tutor stimulated students to formulate clear learning issues, hypotheses and objectives.	19 (3.9)	47 (9.7)	217 (44.7)	202 (41.6)	<0.001
	The tutor encouraged participation by all members in the PBL process.	24 (4.9)	76 (15.7)	196 (40.4)	189 (39)	<0.001
	The tutor provided constructive and timely feedback to the group as a whole.	23 (4.7)	63 (13)	200 (41.2)	199 (41)	<0.001
Overall satisfaction	I would recommend the continued use of online strategies in the teaching of PBL.	34 (7)	69 (14.2)	232 (47.8)	150 (30.9)	<0.001

Table 3. Tutors' perspective of the effectiveness of online PBL (n = 39): Values in parentheses indicate percentages

Dimensions	Items	Strongly Disagree	Disagree	Agree	Strongly Agree	P-value
Technical aspect	I got technical support to perform online PBL.	4 (10.3)	7 (17.9)	22 (56.4)	6 (15.4)	<0.001
	It was easy for me to use Black Board Collaborate (BBC).	1 (2.6)	1 (2.6)	19 (48.7)	18 (46.2)	<0.001
	BBC was just as easy for students to use based on my observations during sessions.	2 (5.1)	3 (7.7)	20 (51.3)	14 (35.9)	<0.001
	There were no or minimal connectivity issues for the tutor and students while delivering online PBL.	1 (2.6)	21 (53.8)	14 (35.9)	3 (7.7)	<0.001
	There were no or minimal delays in audio relay during PBL.	0 (0.0)	18 (46.2)	18 (46.2)	3 (7.7)	0.003
	Our group experienced difficulties sharing the videos, images and Power Points.	4 (10.3)	21 (53.8)	12 (30.8)	2 (5.1)	<0.001
Learning environment and teamwork	I felt comfortable using online PBL.	0 (0.0)	4 (10.3)	20 (51.3)	15 (38.5)	0.006
	My home environment was conducive to deliver online PBL	2 (5.1)	4 (10.3)	20 (51.3)	13 (33.3)	<0.001
	My office environment was conducive to deliver online PBL	6 (15.4)	2 (5.1)	18 (46.2)	13 (33.3)	0.001
	Learning via online PBL is as effective as face-to-face PBL.	6 (15.4)	17 (43.6)	11 (28.2)	3 (7.7)	0.015
	Online PBL is more time-consuming and it has increased my workload.	6 (15.4)	18 (46.2)	10 (25.6)	5 (12.8)	0.013
	Students find the PBL sessions easier to do at home.	9 (23.1)	8 (20.5)	18 (46.2)	4 (10.3)	0.013
Communication and participation	Online PBL was as effective as face-to-face to communicate information orally.	3 (7.7)	16 (41)	18 (46.2)	2 (5.1)	<0.001
	It was difficult to keep track of students' participation since I could not see their faces.	4 (10.3)	16 (41)	11 (28.2)	8 (20.5)	0.049
	Online PBL increased opportunities for quiet students to talk in audio mode.	4 (10.3)	10 (25.6)	16 (41)	9 (23.1)	0.059
	I encouraged students to actively participate in PBL	1 (2.6)	0 (0.0)	18 (46.2)	20 (51.3)	<0.001
Self-directed learning	Online PBL is more effective in improving the critical thinking and reasoning skills of the students than face-to-face sessions.	10 (25.6)	20 (51.3)	8 (20.5)	1 (2.6)	<0.001
	Students had the opportunity to generate issues, hypotheses and objectives.	0 (0.0)	0 (0.0)	29 (74.4)	10 (25.6)	0.002
	I intervened only when students' discussion was going off track or when necessary.	1 (2.6)	1 (2.6)	28 (71.8)	9 (23.1)	<0.001
	Students gathered researched information from authentic and reliable resources.	4 (10.3)	1 (2.6)	27 (69.2)	7 (17.9)	<0.001
Feedback and evaluation	I gave feedback to the students at the end of each class.	0 (0.0)	4 (10.3)	22 (56.4)	13 (33.3)	0.002
	I was able to assess all criteria listed in the PBL assessment rating scale	2 (5.1)	8 (20.5)	20 (51.3)	9 (23.1)	<0.001
	It has become easier for me to fill online PBL Assessment Rating Scale.	6 (15.4)	4 (10.3)	14 (35.9)	15 (38.5)	0.023
Overall satisfaction	I would recommend online PBL.	1 (2.6)	7 (17.9)	22 (56.4)	9 (23.1)	<0.001

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Letter to editor

Challenges and Opportunities of Artificial Intelligence (AI) in Teaching-Learning Process

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Keywords: Artificial Intelligence; Teaching-Learning Process; AI-Driven Teaching Strategies; Opportunities of AI in Education

Dear Editor,

The emergence of AI in recent years has impacted various aspects of human life. The survival and power of countries to compete globally depend on its use in all fields and professions. Education can foster learning and innovation (1-3). Therefore, educational authorities and instructors should proactively plan to integrate this technology into the educational system rather than resisting it.

AI in education presents an unprecedented opportunity to enhance the quality and effectiveness of learning processes. For example, powered by AI, personalized and adaptive learning allows educators to tailor learning based on each student's unique learning model and needs. A study by Smith et al. (2020) demonstrated that adaptive learning algorithms could improve academic success, particularly for students with special needs, by up to 30%, thanks to the timely, data-driven feedback provided to each learner. Additionally, the application of AI in test design and grading has significantly reduced the time and costs associated with educational assessments. Another study by Lee and Chan (2019) showed that AI can effectively participate in educational assessments by determining question difficulty and discrimination indices, which reduces human error. Another significant advantage of AI is its ability to offer 24/7 access to educational systems, allowing students to clarify their doubts anytime. This feature, particularly beneficial for online and inclusive learning environments, has shown high effectiveness in increasing student engagement and interaction (4-6). Various virtual education and mobile applications use this technology to enhance educational quality and effective learning. Some of the aspects that can be highlighted in educating learners include personalized and adaptive learning tailored to the learner's learning model with feedback, efficient content creation without assistance and without spending much time, designing exam questions with correction, grading, providing feedback, and determining difficulty and discrimination indices, 24-hour availability for learner inquiries, identifying educational issues like academic decline and dropout through data mining, access to the latest global resources, determining learners' level in a subject according to individual needs and abilities, reducing cheating and identifying plagiarism in research activities.

However, it seems that despite the advantages and opportunities that AI brings in creating changes and transformations in the teaching-learning process, it also presents challenges, such as the possibility of errors due to the lack of comprehensive, accurate, and detailed data, the emergence of educational discrimination due

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to the lack of access for all learners to AI-related sites, and the absence of laws and regulations related to educational issues, privacy, and intellectual property. Many studies have pointed to these challenges (7-10). One primary issue is the risk of errors due to incomplete or inaccurate data, which can significantly affect educational outcomes. According to Johnson and Wu (2021), errors in AI algorithms in an educational setting can misrepresent student performance by as much as 15%, underlining the need for comprehensive data verification processes to ensure accuracy. Another notable challenge is the risk of educational discrimination, as access to AI-based resources is not equally available to all students. A study by Clark (2022) highlights that students in underserved regions face a disproportionate lack of access to AI tools, exacerbating the digital divide. Therefore, educational institutions should consider establishing partnerships with technology providers to extend resources to low-access areas, promoting educational equity. Finally, the lack of legal and regulatory frameworks around privacy and intellectual property poses a significant hurdle. Without clear guidelines, there is a risk of data misuse and infringement of students' rights. Establishing well-defined legal frameworks in line with higher-level policy documents is essential to safeguard the ethical use of AI in education (11-13).

In conclusion, while integrating AI in education offers transformative opportunities for personalized learning, content creation, and efficiency in assessment, it also presents critical challenges such as data accuracy, educational inequality, and the absence of legal frameworks. These challenges underline the importance of proactive planning and collaborative action among educational authorities.

To address these issues effectively, it is recommended that educational institutions establish dedicated working groups comprising educational specialists, technology experts, and policy advocates. These groups could play a vital role in addressing AI limitations, discussing emerging challenges, and developing guidelines for ethical AI implementation. This novel approach would allow educational environments to benefit fully from AI advancements while ensuring fairness, privacy, and compliance with legal standards. With the formation of such specialized teams, educational institutions can take a proactive stance on AI, setting a sustainable foundation for the future of AI-enhanced education.

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References

1. Mon BF, Wasfi A, Hayajneh M, Slim A. A study on role of Artificial Intelligence in education. Proceedings of the 2023 International Conference on Computing, Electronics & Communications Engineering (iCCECE); 2023 Aug 14-16; Swansea, Wales, UK. 2023. doi: 10.1109/iCCECE59400.2023.10238613.
2. Tahir M, Hassan FD, Shagoo MR. Role of artificial intelligence in education: A conceptual review. World Journal of Advanced Research and Reviews. 2024;22(1):1469-75. doi: 10.30574/wjarr.2024.22.1.1217.
3. Xia Q, Chiu TK, Lee M, Sanusi IT, Dai Y, Chai CS. A self-determination theory (SDT) design approach for inclusive and diverse artificial intelligence (AI) education. Computers & Education. 2022; 189: 104582. doi: 10.1016/j.compedu.2022.104582.
4. Carreon A, Smith SJ, Rowland A. Augmented Reality: Creating and Implementing Digital Classroom Supports. Journal of Special Education Technology. 2020; 35(2): 109-115. doi: 10.1177/0162643419882423.
5. Chen L, Chen P, Lin Z. Artificial Intelligence in Education: A Review. IEEE Access. 2020;8: 75264-78. doi: 10.1109/ACCESS.2020.2988510.
6. Korada L, Sikha VK, Siramgari D. AI & Accessibility: A Conceptual Framework for Inclusive Technology. International Journal of Intelligent Systems and Applications in Engineering. 2024; 12(23s): 983.
7. Akgun S, Greenhow C. Artificial intelligence in education: Addressing ethical challenges in K-12 settings. AI Ethics. 2022;2(3):431-440. doi: 10.1007/s43681-021-00096-7. [PMID: 34790956] [PMCID: PMC8455229]
8. Dakakni D, Safa N. Artificial intelligence in the L2 classroom: Implications and challenges on ethics and equity in higher education: A 21st century Pandora's box. Computers and Education. 2023;5:100179. doi: 10.1016/j.caeai.2023.100179.
9. Zaman BU. Transforming Education Through AI, Benefits, Risks, and Ethical Considerations. TechRxiv. October 05, 2023. doi: 10.36227/techrxiv.24231583.v1
10. Tzoneva I. Benefits and challenges in using ai-powered educational tools. Education and New Developments. 2024; 2. doi: 10.36315/2023v2end079.
11. Wang S, Tran T, Wang J, Wang F, Zhu Z, Du Z. Artificial intelligence in education: A systematic literature review. Expert Systems with Applications. 2024; 252: 124167. doi: 10.1016/j.eswa.2024.124167.
12. Clark, A. The digital divide in online education: Inequality in digital readiness of students and schools. Computers and Education Open. 2022; 3: 100100. doi: 10.1016/j.caeo.2022.100100.
13. Ismail IA, Aloshi JM. Data Privacy in AI-Driven Education: Keeley KL. An In-Depth Exploration in to the Data Privacy Concerns and Potential Solutions. In: AI Applications and Strategies in Teacher Education. 1 Ed. Pennsylvania, USA: IGI Global; 2020: 223-52. doi: 10.4018/979-8-3693-5443-8.

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Original Article

Ranking and Analyzing the Achievement of the Goals of the Integration of Medical Education and the Health System from the Point of View of Academic Staff Members and Using the Fuzzy PROMETHEE

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Abstract

Background: Despite the passage of several decades since the approval and implementation of the plan to integrate medical education and the health system, the analysis and extent of achieving the goals of this plan have been neglected and require careful and detailed investigation.

Objectives: The present study aimed to investigate the achievement of the goals of the integration of medical science education and the health system from the point of view of the faculty members and ranking these goals.

Methods: The present survey was conducted on 548 faculty members at Kerman University of Medical Sciences as the statistical population; however, a total of 225 subjects were selected using Morgan table and stratified random sampling. Data were collected using a questionnaire measuring the 24 goals of merge plan based on five fields. The viewpoint of eight experts as well as fuzzy PROMETHEE was used to rank the goals. Data were analyzed using SPSS 26 and Visual PROMETHEE software.

Results: According to the members of the academic staff, the goals of the integration of medical education and the health system have been fulfilled. From the point of view of academic staff members, therapeutic goals are the goals, which have been most realized. There is no difference from the point of view of the educational group and the academic rank, regarding the realization of the goals of the integration plan. By ranking the goals, it was found that the most important goal of the integration plan is therapeutic goals, followed by educational, health, research, and social goals.

Conclusion: According to the faculty members of Kerman University of Medical Sciences, the goals of the integration plan have been realized; however, it is still far from the ideal. From the point of view of academic staff members and goal-ranking experts, the most important goal of the integration plan is therapeutic goals.

Keywords: Integration; Medical Education; Health System; Faculty Members; Fuzzy PROMETHEE

Background

During the years after the Islamic Revolution, the training of healthcare professionals in Iran underwent tremendous changes (1). The educational program review staff of the medical department was formed in the first years of the establishment of the cultural revolution staff, and it examined the state of medical science education quantitatively and qualitatively and pointed out the existing problems in its final report (2). The great heterogeneity of educational programs in different faculties, the predominant employment of medical science specialists in institutions related to the Ministry of Health or in the private sector, the lack of participation in the education of medical sciences in the country, the significant lack of health manpower in most parts of the country, a lack of emphasis on social aspects in medical science education, and the very low capacity of basic medical science education at master's and

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doctorate levels (only three universities and with limited capacity), were part of the issues raised in this report (3-9).

As a result of the publication of the above research report, with the approval of the Islamic Council in 1985, all the powers, duties, and responsibilities of the Ministry of Culture and Higher Education in medical science education were transferred to the new ministry (3). With the separation of medical science education from the Ministry of Culture and Higher Education, and its integration into the Ministry of Health and Welfare, the Ministry of Health and Medical Education was formed (10).

Finally, in 1985, a new organization named "Ministry of Health and Medical Education" was established from the collection of colleges and higher education institutions of the Department of Medicine and the Ministry of Health. From the beginning of the formation of this ministry, the goals were designed in such a way that each province would have a medical science university that will be responsible for all the educational, research, health, and therapeutic affairs of the respective province. As a result of the integration, knowledge and dynamism of the universities with the experience and follow-up of the healthcare system, the medical system of the country created a coherent system in all relevant matters -from the village to the provincial capital, to improve the medical condition of the country in terms of quantity and quality.

The main goals of this merger and the creation of a single management in matters related to health and medical education at that time were presented as follows:

A. Using all the country's health and treatment facilities to expand medical education and provide the country's needed manpower.

B. Responding better to the health needs of the community by breaking the fence of medical schools from the campus of the school and affiliated hospitals, and transferring the implementation of part of the education in the community, to help make medical education community-oriented.

C. Improving the scientific level of institutions, outpatient service centers, and hospitals of the Ministry of Health by instilling the academic spirit into the above organizations (3, 11).

Also, over time, other goals such as expanding universities and increasing the number of medical students, using more clinical and educational facilities in the medical education system, aligning medical education with the real problems and needs of the society, unifying the human resource and consumer sectors forces appeared (12, 13). In this regard, the mentioned plan increased the number of medical students, faculty members, and medical schools and created the field of community-oriented medical education and expansion of coverage to rural areas (14).

On the other hand, some experts believe that the merger plan causes problems such as lack of attention of officials to educational issues, less efficiency of teaching hospitals despite the high costs, unemployment of graduates of the medical department, lack of motivation of faculty members and students, decline in the quality of the treatment and public dissatisfaction with hospital services (3, 4, 8, 15).

Also, some reports indicate that the integration of medical education with healthcare fields on one hand has led to the development of expert manpower and improvement of health indicators; on the other hand, it has caused a decline in the quality of medical education and the provision of medical services in hospitals (16).

Although the goals, challenges, and problems of the integration plan have been discussed over the decades, the investigation of the goals and the level of achievement appears to have been neglected and requires further investigation. In this sense, in this research, the degree of achievement of the goals of the integration plan has been investigated from the point of view of academic staff members, and then these goals have been prioritized using the fuzzy PROMETHEE approach and the opinions of experts.

Objectives

The current research was conducted with the aim of investigating the achievement of the goals of the integration of medical science education and the health system from the point of view of the faculty members of Kerman University of Medical Sciences and ranking these goals. In addition, this research seeks to answer the following questions:

1. From the point of view of the faculty members of Kerman University of Medical Sciences, what is the extent of achieving the goals of integrating medical science education and the health system?
2. Is there a relationship between the faculty members at Kerman University of Medical Sciences and their attitudes toward the degree of achieving the goals of medical science education and the health system?
3. Is there a relationship between the academic rank of faculty members at Kerman University of Medical Sciences and their attitude toward the degree of achieving the goals of medical science education and the health system?

4. What is the prioritization of the goals of the integration of medical science education and the health system using the fuzzy PROMETHEE method?

Methods

The present survey was performed in 2023. The statistical population included all faculty members of Kerman University of Medical Sciences (n = 548) of whom 225 subjects were selected by stratified random sampling and Morgan table. This sampling method involved all academic departments (seven faculties) in the research. Table 1 shows the number of faculty members at Kerman University of Medical Sciences and the number of subjects selected from each department. Table 1 shows the number of faculty members at Kerman University of Medical Sciences and the number of subjects selected from each department.

A questionnaire of goals was used to evaluate the achievment of the goals of integration of medical science education and the attitude of faculty members toward it. The validity of the questionnaire was evaluated and verified using the opinions of experts and academic staff. To measure the validity of the questionnaire, face validity and content validity were used, based on the opinions of ten experts.

For this purpose, face validity was used; i.e., ten academic staff and experts were asked to express their views on the items of the questionnaire. The experts expressed their opinions about the grammar of the sentences and the spelling of the items, and corrections were made.

The content validity was also checked by content validity ratio (CVR) and content validity index (CVI). To calculate the CVR, the opinions of ten experts were used. They were then asked to rate each question on a three-point Likert scale:

- Essential
- Useful but not necessary
- Not necessary

After gathering the opinions of experts, CVR is calculated using the following equation:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad (1)$$

In this equation:

N: Total number of experts

n_e: The number of experts who have chosen the necessary option.

Based on the number of experts who evaluated the questions, the minimum acceptable CVR value was determined (0.62 with 10 experts; opinion).

To check the CVI index, a questionnaire was used that determined the degree of relevance, Simplicity and clarity of each item with a four-part spectrum (1-4). The number of experts who chose options 3 and 4 is divided by the total number of experts. If the resulting value is less than 0.7, the item is rejected, if it is between 0.7-0.79, it should be revised, and if it is greater than 0.79, it is acceptable.

By performing calculations, CVR=0.88 and CVI=0.92 were obtained. According to the fact that the value of CVR obtained by experts (10 people) is more than 0.62; therefore, from this point of view, the validity of the questionnaires was confirmed. Since the values obtained for this index for all questions were higher than the critical value of 0.79, the validity of the questionnaire was confirmed from this point of view.

Cronbach's alpha coefficient was used to evaluate the reliability of the questionnaire, which was 0.90 and confirmed. The questionnaire used consisted of 27 items (goals) in two parts. The first part dealt with demographic information, including gender, academic department, and academic rank of professors and the second part included items of the goals of integration of medical science education and health system based on five fields: educational, research, therapeutic, health, and social.

Table 1. Number of Statistical Population and Samples Based on Academic Department at Kerman University of Medical Sciences

Academic Department	Statistical Population, N	Sample Size, N	Percentage
Faculty of Public Health	37	15	7%
Faculty of Midwifery and Nursing	28	11	5%
Faculty of Medicine	316	130	58%
Faculty of Allied Medicine	27	11	5%
Faculty of Pharmacy	26	11	5%
Faculty of Dentistry	69	28	12%
Faculty of Management and Medical Informatics	33	14	6%
Faulty of Persian Medicine	12	5	2%
Total	548	225	100%

A five-point Likert scale from 1 to 5 was used for scoring. Thus, faculty members were asked to choose one of the strongly disagree, disagree, no opinion, agree, and strongly agree on options with regard to the degree of their opinions for the degree of achievement of integration goals.

According to the scores given, the average level of degree of goals integration or the line between achieving or not achieving goals of integration was 3.4, because dividing the number of intervals by scales results in a distance of 0.8. Hence, levels of achievement were identified (Figure 1) (17). As soon as the validity and reliability were confirmed, the questionnaire was placed at disposal of the faculty members and then collected after completion.

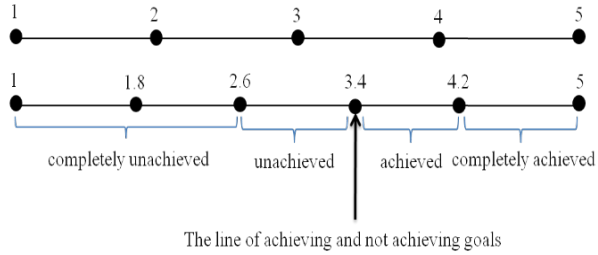

Figure 1. Classification of goals of integration

Data were analyzed using descriptive and inferential statistics. In descriptive statistics, mean and standard deviation and in inferential statistics ANOVA were used. Finally, the data were analyzed using SPSS version 26.

Next, a new fuzzy PROMETHEE was used to rank the goals. It falls into the category of techniques for ranking options. This technique has been successfully used in various fields so far. The fuzzy PROMETHEE introduced by Ho is the combination of fuzzy PROMETHEE with greater flexibility (18).

After examining the the goals of integration of medical science education and health system, the questionnaires were given to experts (one expert per faculty) to determine the importance of each goal according to their viewpoints. Since it was essential to choose participants who were fully aware of the current status, experts were selected from the heads or deputies of each faculty. Since the involved experts had different abilities, experiences, and competencies in group decision-making, different weights were given to them (Table 2).

Since the number of faculty members of the Faculty of Medicine is more than other faculties, and they are divided into two departments of basic and clinical sciences with multiple faculties, two experts were selected from this faculty.

Table 2. Expert Weights to Rank Goals of Integration

Expert number	Faculty related to expert	Expert weight (%)
1	Faculty of Public Health	6
2	Faculty of Midwifery and Nursing	5
3	Faculty of Medicine	23
4	Faculty of Management and Medical Informatics	3
5	Faculty of Medicine	27
6	Faculty of Dentistry	18
7	Faculty of Pharmacy	8
8	Faculty of Allied Medicine	10

The Faculty of Persian Medicine did not participate in this ranking. Since personal characteristics of individuals influence their subjective interpretations of qualitative variables, by defining the domain of qualitative variables, experts responded to the questions with the same mentality. These variables are defined as triangular fuzzy. These variables are defined in Table 3.

Table 3. Triangular Fuzzy Number of Verbal Variables

Verbal variables	Determined fuzzy number	Triangular fuzzy number
Very high	(1,0.25,0)	0.9375
High	(0.75,0.15,0.15)	0.75
Medium	(0.5,0.25,0.25)	0.5
Low	(0.25,0.15,0.15)	0.25
Very low	(0,0,0.25)	0.0625

The fuzzy sets determined by the Minkowski formula were calculated using equation 2.

$$x = m + \frac{\beta - \alpha}{4} \qquad (2)$$

In this equation:

β: Upper limit of the triangular fuzzy number

α: Middle limit of the triangular fuzzy number

m: The lower limit of the triangular fuzzy number.

Also, the fuzzy average of each goal was calculated using equations 3 and 4.

$$A_i=(a_1^{(i)}, a_2^{(i)}, a_3^{(i)}, \ldots, a_n^{(i)}) \quad i=1,2,3,\ldots,n \qquad (3)$$

$$A_{ave}= (m_1, m_2, m_3, \ldots, m_n) = \left(\frac{1}{n}\sum_{i=1}^{n} a_1^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_2^{(i)}, \frac{1}{n}\sum_{i=1}^{n} a_3^{(i)}, \ldots, \frac{1}{n}\sum_{i=1}^{n} a_n^{(i)}\right) \qquad (4)$$

In this equation:

A_i: Expert's view i

$a_n^{(i)}$: Component (goal) opinion

A_{ave}: Average of expert's view

m_n: Expert number

After receiving the questionnaires, the experts described the importance of each question with one of the fuzzy linguistic variables (very low, low, medium,

high, and very high). Then, after evaluating the questionnaires, the data were ranked using fuzzy PROMETHEE in Visual PROMETHEE software (17).

Results

The findings of each goal and their field are shown in Table 4. As seen in Table 4, according to the members of the academic staff, the goals of integrating the education of medical sciences and the health system have been achieved. The total average of goals achieved is equal to 3.98, which is placed in the goal achieved section according to Figure 1.

In addition to the descriptive analysis of the data, in this research, an attempt has been made to reach conclusions about the attitude of the academic staff toward the achievement of the goals of the integration of medical education and the health system. For this purpose and to answer the second and third questions of the research, ANOVA test was used. By comparing the significant values of 0.31 and 0.65 with a significance level ($\alpha = 0.05$), it is determined that the p-value is higher than the acceptable error value ($P > 0.05$). Therefore, it can be stated with a 95% confidence interval that there is no relationship between the educational group and the academic rank of the academic staff members of the University of Medical Sciences and the achievement of the goals of the integration of medical science education and the health system of the academic staff members.

To answer question 4 and rank the goals of integration of medical science education, the experts were provided with a questionnaire to determine the importance of each question through verbal variables. Mean fuzzy scores of goals on the importance of goals are presented in Table 5.

Table 4. Success Degree of the Integration Plan in Achieving the Goals According to the Faculty Members

Item	Goals	Mean (SD)
1	Creating more coordination between different departments of health care and educational services in the country	4.21(0.90)
2	The use of educational system and more medical facilities	3.95(0.93)
3	Adapting medical education to the real problems and needs of society	4.04(0.92)
4	Improving the quality of medical science education	3.78(0.95)
5	Development of educational services such as increasing specialized fields and developing other fields of medical groups	4.17(0.96)
6	Development of educational facilities such as educational space and related equipment	4.11(0.97)
7	Responding to real educational needs	3.48(0.93)
Educational Goals		
8	Quantitative growth of research in medical sciences	4.09(0.98)
9	Qualitative growth of research in medical sciences	3.38(0.90)
10	Conducting applied research based on the needs of society in various medical fields	3.80(1.06)
Research Goals		
11	Improving the quality of health services	4.10(0.96)
12	Better coverage and small expansion of healthcare services	4.52(1.00)
13	Development of medical services, including increasing hospital beds and increasing the ratio of doctor to patient	4.34(0.97)
14	Responding to the medical needs of the community	4.38(0.94)
15	Improving the quality of medical services (including reducing mortality and hospital infections)	4.28(0.99)
16	Technological development and scientific improvement of medical services	4.14(1.00)
17	Self-sufficiency in the field of human resources in the health sector	4.10(1.00)
Therapeutic Goals		
18	Improving health indicators such as morbidity and mortality	3.98(1.02)
19	Improving the coverage of health services and increasing people's access to health services	4.20(0.98)
20	Ease of access to health service centers and hospitals	4.42(0.87)
21	Improving the quality of health services	4.64(0.86)
Health Goals		
22	Improving the level of community health	3.75(0.91)
23	Transforming the vision of graduates toward serving society due to direct involvement with services	3.42(0.95)
24	Change and reform the attitude of academic faculty members from a mere university to an insight based on the needs of society	3.56(0.90)
Social Goals		3.58(0.83)
All Goals		3.98(0.79)

Table 5. Mean Defuzzified Scores of Experts

Expert number	Educational	Research	Therapeutic	Health	Social
1	0.8356	0.7185	0.8996	0.8278	0.7810
2	0.7748	0.5625	0.8122	0.8903	0.7498
3	0.8669	0.7185	0.8496	0.7731	0.7731
4	0.7622	0.7810	0.8622	0.6096	0.8669
5	0.7748	0.8356	0.9370	0.8278	0.7810
6	0.8496	0.7622	0.7748	0.7185	0.5468
7	0.7731	0.7622	0.8278	0.7810	0.7185
8	0.7185	0.8590	0.8996	0.7810	0.7263

These scores were the inputs of Visual PROMETHEE to rank the goals. According to the software output shown in Figure 2, therapeutic goals were the most important goals, followed by educational, health, research, and social goals.

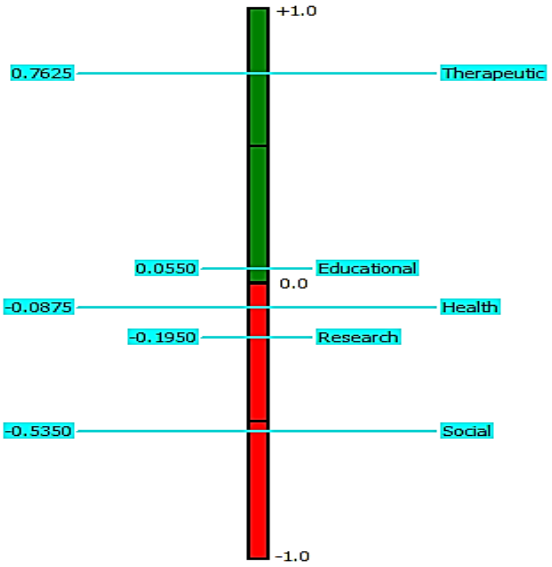

Figure 2. Visual PROMETHEE software output and ranking of integration goals

Discussion

This study analyzed the achievement of the objectives of the integration of medical science education and the health system and their ranking using the fuzzy-parametric approach from the perspective of academic staff members at Kerman University of Medical Sciences. We demonstrated that, overall, the goals of the merger have been achieved from the perspective of academic staff members (3.98). However, to fully achieve all educational, research, therapeutic, health, and social goals, sustained efforts and greater collaboration among all relevant departments are essentia.

The research findings showed that among the goals of educational goals, goal 2 got the lowest mean score, indicating that the goals integration (improving the quality of medical science education), is a goal that is less achieved. Additionally, comparing the values of the educational goals with Figure 1 reveals that all the educational objectives of integrating medical education with the health system have been achieved from the perspective of academic staff members. Among these, goal 1 (enhancing coordination between various healthcare and educational service departments nationwide), with an average score of 4.21, has been fully realized.

Goals 8, 9, and 10 are related to the research goals of the integration plan. Based on the average goals as a whole from the point of view of academic staff members, the integration plan has achieved the desired research goals (3.76). However, in these goals, the goal (qualitative growth of research in medical sciences) with an average of 3.38 and according to Figure 1 has not been achieved. In other words, the integration plan has not been able to improve the quality of medical science research, and more attention should be paid to this issue.

According to Table 4, goals 11 to 17 are related to the therapeutic goals of the integration plan. The academic staff members of the university believe that these goals have been well achieved, and the values above 4 for these goals are an indication of this. Also, the average of the total therapeutic goals, with a value of 4.27, confirms this. In fact, the members of the academic staff believe that with the creation of the integration plan for medical education and the health system, the therapeutic goals of the plan have been fully achieved. Meanwhile, goal 12 (better coverage and small expansion of healthcare services) has the highest value with an average of 4.52.

Goals 18 to 24 are related to health goals of the integration plan. Academic staff members believe that these goals have been well met. Faculty members believe that, with the integration plan, the quality of health services has become very appropriate (4.64). Although the goals of improving health indicators, such as mortality, have been achieved among these goals, more work is needed.

According to Table 4, goals 22 to 24 are related to the social goals of the integration plan.

It seems that from the point of view of the academic staff, the social goals of the integration plan of medical education and the health system have been achieved. Among these goals, the average goal 23 (Transforming the vision of graduates toward serving society due to direct involvement with services) has a lower value, which should be more focused on.

The second and third questions of this research seek to investigate the relationship between the educational group and the academic rank of the faculty members of Kerman University of Medical Sciences with their attitude toward the achievement of integration goals. As the findings showed, the attitude of academic staff members has no significant relationship with the education group and academic rank. In other words, there is no difference in the attitude of academic staff members in different faculties, as well as academic staff members, lecturers, assistant professors, associate professors, and professors, regarding the level of access to the goals of the integration plan in Kerman University of Medical Sciences.

Ranking factors using expert opinions and fuzzy PROMETHEE showed that the therapeutic goals were the most important goals for integration plan. This indicates that, with the integration plan, it is expected that therapeutic goals will be considered more. Given that the people of our country face numerous treatment challenges, including high therapeutic costs, limited access to timely and accurate care, and widespread issues with obtaining certain medications, achieving therapeutic goals is of utmost importance.

On the other hand, the findings of the present study have made it clear that the social goals related to the integration plan, which played an important role in the initial formation of this plan, have had the least amount of success. The integration plan was established with the belief that medical education cannot be confined to a closed environment but must be connected to society. However, it appears that due to the vast expansion of other activities within the new system, effectively implementing this concept has become challenging. In other words, the results indicated that social goals were the least successful. In fact, this plan has made the least progress in achieving one of its primary objectives. This finding, related to a key element of the integration plan, suggests potential structural issues within the current system, and further studies in this area appear to be necessary. Therefore, according to the results of the present study and other reports, additional studies are suggested regarding the inadequacies of the current system in achieving some of its goals.

Conclusion

In general, considering that the integration of medical education and the health system has been the subject of much debate and disagreement, with occasional proposals to separate medical education from the Ministry of Health, the findings of the present study-based on a survey of academic faculty members-deserve attention and emphasis. What was done in this research was in order to understand part of the existing conditions and the degree of achievement of the goals, and it was discussed in the form of five goals (therapeutic, educational, health, research, and social goals) from the perspective of the academic staff of Kerman University of Medical Sciences, and it was concluded that the overall goals of integrating medical education and the system Health have been achieved. A comprehensive understanding of the facts, conditions, and achievement of the goals requires the use of additional tools that can be explored through further studies. Given the importance of the topic, it is recommended to conduct the study on a larger scale at other universities and address the weaknesses in the current structure to correct them.

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References

1. Farsi Z, Nasiri, M, Sajadi SA, Khavasi M. Comparison of Iran's nursing education with developed and developing countries: a review on descriptive-comparative studies. BMC Nurs. 2022 May 6;21(1):105. doi: 10.1186/s12912-022-00861-x. [PMID: 35524262] [PMCID: PMC9073817]
2. Nadim A, Shadpour K, Holakouei K, Naghavi M, Nikpour B, Alai M. Opinion survey on joining of health care organization with university of medical sciences. Hakim Research Journal. 1999; 2(2): 67-74. [In Persian]
3. Shackebaei D, Karami Matin B, Amolaee K, Rezaie M, Abdolmaleki P, Reshadat S et al. Achieving the goals of integration of medical education and health service delivery systems from the viewpoint of the faculty members of Kermanshah University of Medical Sciences. *Sci J Kurd Univ Med Sci.* 2011; 16(1): 81-91. [In Persian]

4. Board of Directors of Iranian Association of Medical Education. The Study of the status of integration of medical education with system services in Iran and World. IN: Scientific association of medical education, Analysis of scientific documentation and administrative integration of medical education and care system.1st ed. Tehran: Third millennium culture 2003; 157-63. [In Persian]
5. Haq CL, Mohmmadi A, Smith SR. Medical Education Reform in Iran. Family Medicine; 2003; 35(9): 616-7.
6. Noori Hekmat S, Haghdoost A, Dehnavieh R, Ghorbani nia R. The Consequences of Integration of the Medical Education and the Health Services System of Iran: A Systematic Review and Meta-Synthesis of Literature . Iranian Journal of Epidemiology. 2019; 14 :12-26. [In Persian]
7. Nedjat S,Yazdizadeh B,Gholami J, Ashorkhani M, Nedjat S, Maleki K, et al. Effect of ministry of health and medical education structure on application of medical research. Hakim Research Journal. 2008; 11(3): 1-10. [In Persian]
8. Abbasi Moghaddam MA, Razavi SM, Nooraei SM. Attitude of Key Academic Persons About Integration of Medical Education into Health Services. Tehran Univ Med J. 2004; 62 (1): 80-8. [In Persian]
9. Walton H. Global demands on medical education, the case of Iran. Iran J Med Edu. 2001; 1(2):14-7.
10. Azizi F, Entezari A, Momtazmanesh N, Pezeshkian M, Tabrizchi N. Impact of Integration of Medical Education in the Health System of Islamic Republic of Iran. Strides Dev Med Educ. 2024; 21(Suppl): 1-9. doi: 10.22062/sdme.2024.92416.
11. Ahmady S, Hassanzadeh G, Namaki A, Kalantarion M, Shahbazi S, Habibi A, et al. An Exploration of Stakeholders' Perspectives in the Seventh National Conference on the Integration of Medical Education into the Healthcare System in Iran. Strides Dev Med Educ. 2024; 21 (Suppl): 10-19. doi: 10.22062/sdme.2024.198970.1276.
12. Yadavar Nikravesh M, Biabangardi Z. The effect of medical sciences universities, on the health care delivery, the point of view of authorities of universities. Iran J Med Edu. 2002; 2: 57. [In Persian]
13. Alishiri GhH, Azad Marzabadi E, Hosseini SM, Fajrak H, Nouri R. Comparison between Academic Staffs and Students' Views about the Teacher's Evaluation Form in Theoretical Lessons. Educ Strategy Med Sci. 2013; 6(3): 135-9. [In Persian]
14. Bagherinezhad Z, Malekzadeh R, Abedi G. Analysis the Integration of Medical Education with the Provision of Healthcare Services in Iran with a SWOT Approach. Strides in Development of Medical Education, 2024; 21(Suppl): 20-33. doi: 10.22062/sdme.2024.198972.1278.
15. Sadr Arhami N, Kalantari S, Atarod S. Medical Students Attitude Towards Their Field of Study And Future Career. Iran J Med Educ. 2004; 4(1): 76-81. [In Persian]
16. Sajadi -Jazi SJ. Integration of Education and Research into Healthcare Services According to Health Upstream Documents in the Islamic Republic of Iran. Strides in Development of Medical Education. 2024; 21(Suppl): 57-61. doi: 10.22062/sdme.2024.200591.1478.
17. Parhizgar MM, Fazel A, Harandi A. Readiness for Electronic Learning and Ranking of Related Factors Using the Fuzzy PROMETHEE: A Study at Kerman University of Medical Sciences, Iran. Strides Dev Med Educ. 2019; 16(1): 2-9. doi: 10.5812/sdme.84403.
18. Gul M, Celik E, Gumus AT, Guneri AF. A fuzzy logic-based PROMETHEE method for material selection problems. Beni-Suef University Journal of Basic and Applied Sciences. 2018;7(1):68–79. doi: 10.1016/j.bjbas.2017.07.002.

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Review Article

Indicators of Internationalization in Higher Education Institutions: A Systematic Review

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Abstract

Background: Despite the numerous advantages of internationalization, universities and higher education institutions (HEIs) often encounter challenges when implementing internationalization activities. Part of the problem concerns the vague definition of internationalization and its performance indicators.

Objectives: The present research aims to identify indicators for internationalization in universities and (HEIs) by conducting a comprehensive literature review to help universities better understand and implement internationalization activities and processes.

Methods: This study is a systematic literature review, informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, in which six bibliographic databases, including Web of Science, Educational Resources Information Center (ERIC), ScienceDirect, and Wiley Online Library for English literature and Scientific Information Database (SID) and MagIran for the Persian literature were searched in 2023. Approved articles underwent synthesis, and findings were analyzed using qualitative content analysis.

Results: A total of 2086 articles were identified, out of which 37 were selected for content analysis. The content analysis and final synthesis revealed six overarching themes consisting of 12 subthemes, 38 groups, 11 subgroups, and 466 codes. The main themes included education (with three subthemes of internationalization at a distance, quality assurance and continuous improvement of internationalization, and internationalization of education, teaching, and learning outcomes), international aspects (with two subthemes of international public relations and communication, and international cooperation and networking), research (with two subthemes of internationalization of research, and commercialization of ideas and innovations), students (with two subthemes of student welfare/support services, and cultural/social services), management and human resources (with two subthemes of management, and human resources), and healthcare (with one subtheme of healthcare and treatment).

Conclusion: The results necessitate consideration of several indicators, rendering internationalization a multifaceted challenge that requires inter-sectoral cooperation at both internal and external university levels. The results hold significance for international relations managers and education policymakers in facilitating the planning and implementation of internationalization activities.

Keywords: Indicators; Internationalization; Universities; Higher Education Institutions

Background

It has been more than three decades since the discussion of the internationalization of higher education at national levels started in many countries as an important aspect of responding to the challenges and needs caused by globalization (1). In many universities and Higher Education Institutions (HEI), the concept of internationalization has received much attention and is

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becoming one of the main concerns of universities around the world. The importance of internationalization is so great that many universities and HEIs have gone beyond and included it in their vision/mission statements, operational plans, national institutional frameworks, and the content of their curricula (2). Knight has defined the internationalization of higher education at national, sectoral, and institutional levels as "the process of integrating the international, intercultural, or global dimension into the goals, functions, and delivery of higher education" (3). The internationalization of higher education has experienced many changes in recent years and has changed from a concept that was only related to the transfer of students to a broader concept that includes academic programs (student exchange programs, foreign language training, internationalization of curriculum), scientific research (international joint research projects, international conferences, and conventions), extracurricular activities, and international relations (4-7). Internationalization is one of the ways to respond to the effects of globalization while fully respecting the national identity (8). Universities and HEIs have realized more and more that internationalization is a necessity and a mission for all departments of a university rather than a marginal activity.

In Asian countries, creating world-class universities and promoting them in global rankings are often on the agenda of the internationalization of universities, and governments such as China and South Korea have adopted strategic policies to achieve such goals (9). Pre-defined and quantitative Key Performance Indicators (KPI) associated with governments' internationalization initiatives have also become commonplace with the rise of such policy measures (10). However, the problem is that achieving quantitative KPIs is often the end goal in some universities, and less emphasis is on improving the quality of internationalization activities. Most of the indicators in global ranking systems and academic journals are quantitative and of the same type as KPIs and are of the same problem (11).

Numerous studies have been conducted to investigate the internationalization of higher education, considering internationalization at organizational levels and internationalization of curricula and learning outcomes. The Organization for Economic Co-operation and Development (OECD) has provided a tool called "Internationalization Quality Review Process" to evaluate internationalization. This assessment includes internationalization policies, support structures, academic programs, grants and contracts, students, scientific cooperation and research, and human resource development programs and opportunities (12). Ellingboe's Six Dimensions of Internationalization (1998) is the result of two large research studies in American universities (13). Five of these dimensions, i.e., faculty participation in international activities, international curriculum, study abroad, international students and researchers, and leadership, are mentioned in almost all internationalization documents and thus represent key components at the international level (13). In Paige's (2005) internationalization model, key functional categories include university leadership for internationalization, internationalization strategic plan, institutionalization of education, infrastructure and staff, internationalized curriculum, international students and researchers, studying abroad, participation of professors in international activities, extracurricular activities in the university environment, and monitoring the internationalization process (14).

In Iran, several studies have been conducted to investigate the internationalization of higher education at the institutional level and the internationalization of curricula and learning outcomes (15-19). Additionally, by interviewing 16 academic experts, Zamanimanesh et al. (2016) designed a local model for the internationalization of Iran's medical sciences universities (17). The conceptual model of their research included infrastructure (which indirectly and imperceptibly affects internationalization) and superstructure factors (which directly and visibly give medical sciences universities an international image). The infrastructure factors also included global and regional conditions, cultural and economic conditions, and political and security conditions, while the superstructure factors included management and human resources, scientific cooperation, space and equipment, curricula, extracurricular activities, monitoring and evaluation, and academic culture (17).

In Iran, despite the fact that the upstream documents and related long-term plans, such as "The 20-Year Vision Document," "The Comprehensive Scientific Map of the Country," "The Major Objectives of Science and Technology System," "The Sixth Five-Year Development Plan Law," and "Transformation and Innovation Programs of Medical Education," by the Ministry of Health, Treatment and Medical Education

explicitly emphasize on the development of science and technology in the world and the expansion of international cooperation in all fields of science and technology, Iranian universities and HEIs are facing challenges in assuming the roles, priorities, and strategies of internationalization.

Objectives

The present study aimed to provide a comprehensive set of quality indicators that can be used for self-evaluation and peer evaluation of internationalization performance. The present study intended to provide a manageable set of internationalization evaluation indicators for universities and HEIs through a comprehensive review of existing literature. These indicators allow universities to analyze their current situation in relation to their internationalization activities, identify their weaknesses, and develop strategies and plans for internationalization improvement.

Methods

This study is a systematic literature review conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, in which available original English papers related to indicators, criteria, or standards of internationalization of universities and HEIs were searched. The Patient, Intervention, Comparison, Outcome (PICO) framework was applied to identify and define the research population (universities and HEIs), intervention (internationalization activities), comparison (N/A), and outcome (self-reported effectiveness). The six bibliographic databases included Web of Science, Educational Resources Information Center (ERIC), ScienceDirect, and Wiley Online Library for English literature and Scientific Information Database (SID) and MagIran for Persian literature. All retrieved articles (n=2086) were examined. The data collection tool was a research-made form consisting of various fields, such as author, title, journal name, year, publication date, uniform resource locator (URL) of the article on the web, abstract, link to the full text of the article, organizational affiliation of the first author, country, type of study, data collection method, participants, number of participants, and main findings, which were organized in the form of a table. The validity of the form was confirmed through review by the research team, which has expertise and experience in the field of qualitative research methods. Original research articles published in both Persian and English languages were searched in the target databases by applying a time span of 1 January 2017 to 16 July 2023.

Search Strategy

Keywords included Evaluation, Assessment, Accreditation, Quality, Standard, Criteria, Indicator, Internationalization, University, Higher Education, and their respective Persian equivalents. Boolean operators (AND, OR, NOT) were used appropriately to construct the search query.

Examples of English search queries included as follows:

- ((Evaluation OR Assessment OR Accreditation) AND Quality AND Internationalization AND (University* OR (Higher AND Education AND Institution*))
- (Internationalization AND University* AND (Standard OR Indicator*))
- (Quality AND Internationalization AND (University* OR Higher Education) AND Iran)
- (Evaluation AND Quality AND Internationalization)

Inclusion Criteria

- Being related to the research purpose, i.e., focusing on:

✓ Internationalization standards/ indicators/ dimensions/ strategies/ policies in universities and HEIs
✓ Pillars/ elements/ models/ frameworks/ patterns of internationalization
✓ Development and implementation of internationalization
✓ Internationalization of education and curricula
✓ Internationalization of research
✓ Original research articles

- The time span of 1 January 2017-16 July 2023
- Both English and Persian languages
- All countries/geographic regions

Exclusion Criteria

- Out of the study scope and focused on other issues of internationalization, including but not limited to:

✓ Political theories/ colonialism and post-colonialism/ Westernization
✓ Women's studies/gender studies
✓ Intercultural competence/ sensitivity among students/ academic staff
✓ Pedagogical aspects of English Language Teaching (ELT) and English as a Foreign Language (EFL)

- Systematic reviews, conference papers, book chapters, notes, editorials, book reviews

Screening and Data Extraction: In order to analyze data, retrieved papers were reviewed in terms of their

relevance to the research aim. The criteria for accepting the articles were to address at least one of the goals specified in this research. After reviewing the titles and abstracts of the articles, relevant items were extracted for full-text reading.

Quality Assessment

Quality assessment was undertaken focusing on the purpose of the review as explained earlier and on the following criteria: (a) The validity of the methods, (b) how far the specified outcomes were supported by the study findings, and (c) to what extent the content of the study described internationalization indicators/ activities in universities and HEI.

Data Synthesis: The full text of the selected articles was analyzed and described using the qualitative content analysis method (20). In this method, concepts are classified in the form of analysis units, meaning units, codes, categories, and themes. The analysis unit is the smallest and most specific concept identified in the content and can be visual or verbal. Examples of analysis units include phrases, sentences, paragraphs, and images. All 37 articles underwent thorough quality assessment, and none were found to lack quality.

Results

Overall, 2086 article titles, 1102 article abstracts, and 731 full-text articles were reviewed, of which 37 articles were accepted for final analysis (Figure 1). A summary of the reviewed studies is presented in Table 1.

Content analysis and final synthesis of findings included the identification and extraction of six themes, 12 sub-themes, 38 groups, 11 subgroups, and 466 codes. The main themes included: Education, international relations, research, student welfare services, management and human resources, and healthcare services and treatment. The sub-themes and sample codes in each of the six themes are described in Table 2. In some themes and groups, due to the large number of codes, only examples have been mentioned.

Discussion

The field of education holds significant importance in the internationalization of universities and HEIs, with the highest number of indicators. Following that, the field of management and human resources comes into play, followed by the field of international relations, which exerts a great influence on the university's internationalization efforts. The field of healthcare and treatment, being a secondary focus for some universities and HEIs worldwide, possesses the fewest number of indicators and thus holds less significance in terms of the internationalization of HEIs. While the attention and application of internationalization in universities and HEIs is increasing, there are many ambiguities about its meaning and application. There are several models for implementing internationalization in universities, and various measurement indicators for university internationalization have been proposed by various researchers, among which are the studies and indicators provided to serve universities in England (21), United States (22), Australia (23), Germany (24), Netherlands (25), Japan (26), Taiwan (27), and China (28).

In Iran, several studies have presented models of internationalization of higher education and highlighted significant indicators (2, 18, 29-31). There are various classifications available that help organize indicators into important groups based on the structure and functions of universities. In the literature, numerous dimensions and indicators of internationalization have been discussed. However, the most comprehensive collection of indicators was published in 2010 by the Indicators for Mapping and Profiling Internationalization (IMPI) report. This publication classified a comprehensive set of 489 indicators into nine distinct dimensions, including students, staff, administration, funding and finance, curricular and academic services, research, promotion and marketing, non-academic services, campus and community life, and others (26). In 2018, the United Nations Educational, Scientific and Cultural Organization (UNESCO) Bangkok proposed other dimensions, such as social participation and institutional networks. As all member states of the United Nations adopted the Sustainable Development Goals in 2015, the third mission of a university, social participation, was emphasized in the internationalization of higher education (32). In the present research, the common denominator of the reviewed studies showed that internationalization could be implemented in most of the five main dimensions of education, international relations, research, student welfare services, and management and human resources (33-35).

According to the results of this review, student/staff exchange, including virtual exchange or mobility, particularly during the coronavirus disease 2019 (COVID-19) pandemic and health emergencies (2, 17, 30, 36-48), use of virtual and online platforms for teaching (15, 19, 38, 39, 47-53), use of English language in teaching (18, 36, 40, 41, 51, 53-55), internationalization of curricula (15, 19, 37, 38, 41, 47, 55, 56), and admission of foreign students (2, 33, 36, 37, 40, 47, 49-51) are

frequent indicators in the internationalization of education, learning, and teaching.

During the COVID-19 pandemic, most of the articles in the field of internationalization of higher education have focused on using the capacities of virtual space and information and communication technologies (ICT) for internationalization, or have addressed educational challenges from the perspective of professors or students. The COVID-19 pandemic has disrupted many aspects of higher education, particularly the internationalization activities that involve the physical mobility of students and staff. To cope with this challenge, some universities have adopted virtual machine (VM) as an alternative way of providing international learning experiences to their students (39, 45, 48). While VM can offer benefits, including increased access, flexibility, diversity, and sustainability, it also faces challenges, such as quality assurance, recognition, equity, and inclusion. According to a recent report by UNESCO-International Institute for Higher Education in Latin America and the Caribbean (IESALC), VM has become more prevalent and diverse during the pandemic, but it still needs to be further integrated into the curriculum and supported by adequate policies and resources (32).

In the international relations field, most of the reviewed studies have focused on the importance of indicators, such as the active engagement of faculty members in international associations and forums (16, 18, 19, 30, 47, 57), academic development and joint and international capacity building projects (15, 38, 41, 43, 58), development of international cooperation (40, 43, 46, 54), signing memorandums of understanding (MoU) and memorandums of agreement (MoA) (18, 43, 44), and establishing international campuses/ branches (15, 18, 33, 35, 51).

While membership in international scientific associations is an important indicator, it has been less noticed by universities, particularly smaller universities with more limited financial resources, but considering its impact on networking, it plays an important role in creating international relations and its development. In the field of research, the results demonstrate that indicators, such as joint research projects (2, 15, 18, 30, 35, 37, 40, 45, 46, 49, 52, 55, 57, 58), organizing international/ joint workshops, seminars and conferences (2, 15, 17, 30, 35, 45, 47, 49, 50, 52), obtaining international research grants/ funds (15, 19, 33, 40, 47, 55), joint research with international organizations (37, 46, 49, 57), and publication of articles in widely-recognized international journals (17, 33, 47, 53, 55), are among important indicators.

Joint research collaborations are a widely-defined indicator and is a portal for starting and implementing a variety of international activities, such as signing memorandums and research contracts, exchange of professors/ researchers, attracting research grants, cooperation with international research organizations, attracting postdoctoral researchers, and presenting research results in conferences and international events, and as a result, it is of great importance in the internationalization of research profile of universities.

In management and human resources, indicators, such as the inclusion of internationalization in the mission/ vision statement of the university (15, 18, 19, 35, 52, 58, 59), attracting guest/ visiting professors from international universities and institutions (33, 35, 40, 47, 50, 51, 55), developing the language skills of professors and staff (18, 36, 55), providing study opportunities for professors (15, 19, 30, 55) and developing a strategic plan for internationalization (15, 33, 58), are among the most frequent indicators. The importance of including internationalization in the mission/ vision statement of the university is so great that it was mentioned in almost all the reviewed studies.

In a study conducted in more than 100 universities in the United States, the researchers concluded that the importance of internationalization should be included in the statements, missions, and visions of the university, and a motivational and communication organizational structure should be provided to establish international communication (60). Another important indicator of this field is the attraction of international/ visiting professors, which seems to be the biggest weakness of Iranian universities. Due to legal restrictions and inadequate infrastructure, challenges in paying foreign professors, and financial transfer challenges, Iranian universities, in particular, are less willing to attract foreign professors/ employees (17).

Considering that government financial support is one of the most important factors affecting the attraction of international students and professors, it is necessary for universities to be financially supported by the government in order to be internationally competitive (61). In the student welfare services field, the most frequent indicators include developing intercultural communication skills (50), holding events inside/ outside the university for intercultural exchange (51), providing various services for international students (17), advising and guiding international

students (15), and increasing flexibility in facing different cultures (17). Internationalization has changed global platforms for education and connects three economic, political, and cultural dimensions with scientific and academic issues. In the cultural dimension, internationalization is an important factor in deep cultural influence, changing social views and cultural influence (62).

The articles reviewed in this study mainly focus on the internationalization of teaching and research missions of universities while neglecting service missions, such as providing healthcare services to society. This indicates a research gap in this area, particularly for countries like Iran, where such services are vital. Future research should address the internationalization of the services that universities offer to the public and citizens, for example, in the field of health tourism. Moreover, the new roles of universities as entrepreneurial institutions and the impact of internationalization on them are also underexplored and deserve more attention in future studies.

Conclusion

As shown by the results of this study, internationalization in universities and HEIs is a multifaceted and interdepartmental issue requiring the interaction and cooperation of all departments of a university and the integration of internationalization in all current processes of a university, such as educational services, research affairs, international affairs, student affairs, cultural and welfare services, management and human resources, and even healthcare services and treatment. While many dimensions and indicators of internationalization have been frequently discussed in the literature, the issue of using indicators to implement accreditation systems and evaluate the quality of internationalization in universities and HEIs and its effectiveness on quality improvement activities and processes has been less researched. The indicators identified in this research can be used in the establishment of such quality accreditation systems for the internationalization of universities. The results of this research help policymakers in the field of internationalization of higher education in evaluating the quality of processes and benchmarking activities.

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References

1. Teichler U. The changing debate on internationalisation of higher education. Higher Education. 2004; 48(1): 5-26. doi: 10.1023/B:HIGH.0000033771.69078.41.
2. Jafari S, Rahimian H, Abbaspour A, Ghiasi Nadooshan S, Khorsandi Taskoh A. A Model for Internationalization of Universities in the Fields of Humanities and Social Science. Journal of higher education curriculum studies. 2017;9(17): 67-91. [In Persian]
3. Knight J. Five myths about internationalization. International Higher Education. 2011; (62):14-5.
4. Altbach PG, Knight J. The internationalization of higher education: Motivations and realities. Journal of Studies in International Education. 2007;11(3-4):290-305. doi: 10.1177/1028315307303542.
5. Altbakh PG, De wit H. Are We Facing a Fundamental Challenge to Higher Education Internationalization? International Higher Education. 2018;93:2-4. doi: 10.6017/ihe.0.93.10414.
6. de Wit H. Internationalization of higher education in the United States of America and Europe. In: Altbach PG, editor. 1st ed. Westport, CT: Greenwood Press; 2002.
7. Wächter B. An introduction: internationalization at home in context. Journal of studies in international education. 2003;7(1): 5-11. doi: 10.1177/1028315302250176.
8. Jocelyne GÁ Higher education, internationalization and integration in Latin America and the Caribbean: regional balance and outlook. Proceedings of the 3rd Regional Conference on Higher Education; 2018 Jun 14; Córdoba, Argentina. 2018. [In Spanish]
9. Li H, Axbey H, Riddle S. Challenges of implementing internationalization of higher education in China. Proceedings of the Imagining Better Education; 2019 Aug 19; Durham, England. 2019: 46-58.
10. Helms RM, Rumbley LE, Brajkovic L, Mihut G. Internationalizing Higher Education Worldwide: National Policies and Programs. Washington DC, US: American Council of Education: 2015.
11. Shin JC, Kehm BM. The world-class university in different systems and contexts. In: Shin JC, Kehm BM, editors. Institutionalization of World-Class University in Global Competition. Dordrecht, Netherlands: Springer; 2013: 1-13. doi: 10.1007/978-94-007-4975-7_1.
12. Wit H, Knight J. Quality and Internationalisation in Higher Education: Organisation for Economic Co-Operation and Development. Paris, France: OECD; 1999.
13. Ellingboe BJ. Divisional strategies to internationalize a campus portrait: results, resistance, and recommendations from a case study at a U.S. university. In: Mestenhauser JA, Ellingboe BJ, editors. Reforming the Higher Education Curriculum: Internationalizing the Campus. Phoenix, Arizona: The American Council on Education/ Oryx Press; 1998: 198–228.
14. Paige RM. Internationalization of higher education: performance assessment and indicators. Nagoya Journal of Higher Education. 2005;5(8):99–122.
15. Zamanimanesh H, Assareh A, Ahmadi GA. A Study of Mechanisms of Internationalization of Higher Education System

in Iran. Strategy for Culture. 2019;12(45):153-85. doi: 10.22034/jsfc.2019.95593. [In Persian]
16. Zamani Manesh H. A Confirmatory Factor Analysis of Effective Solutions for Internationalization of Medical Sciences Curriculum: Faculty's Viewpoint. Journal of Medicine Spiritual Cultivation. 2017;26(3):197-212. [In Persian]
17. Zamani Manesh H, Khorasani A, Bakhtiari T. Designing a native model for the internationalization of Iran's medical sciences universities: a qualitative study. Research in Medical Education. 2017;9(2):44-56. doi: 10.29252/rme.9.2.56. [In Persian]
18. Zamani Manesh H, Assareh A, Ahmadi G. Designing the Conceptual Framework of the Islamic International University: A Qualitative Study. Management in Islamic University. 2018;7(1):107-28. [In Persian]
19. Zamani Manesh H, Jamali-Tazeh Kand M, Nazari R. Effective factors on Internationalization of Medical Education from Faculty Members' Viewpoints in Shahid Beheshti University of Medical Sciences Members. Res Med Edu 2018; 10(2): 38-45. doi: 10.29252/rme.10.2.38. [In Persian]
20. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004 Feb;24(2):105-12. doi: 10.1016/j.nedt.2003.10.001. [PMID: 14769454]
21. Ayoubi RM, Massoud HK. The strategy of internationalization in universities: a quantitative evaluation of the intent and implementation in UK universities. Journal of educational Management. 2007; 21(4): 329-49. doi: 10.1108/09513540710749546.
22. Horn AS, Hendel DD, Fry GW. Ranking the international dimension of top research universities in the United States. Journal of Studies in International Education. 2007;11 (3-4):330-58.
23. Krause KL, Coates H, James R. Monitoring the internationalization of higher education: are there useful quantitative performance indicators? In: Tight M, editor. International Relations: International Perspectives on Higher Education Research. Wagon Lane, Bingley: Emerald Group Pub; 2005: 233-53. doi: 10.1016/S1479-3628(05)03010-8.
24. Brandenburg U, Federkeil G. How to Measure Internationality and Internationlisation of Higher Education Institutions! Indicators and Key Figures. Gütersloh, Germany: Center for Higher Education Development; 2007.
25. van Gaalen A. Developing a tool for mapping internationalisation: a case study. In: de Wit H, editor. Measuring Success in the Internationalisation of Higher Education (EAIE Occasional Paper No 22). Amsterdam: European Association for International Education; 2009: 77-91.
26. Watabe Y, Ota H. Developing a manageable system of internationalization indicators for universities in Asia. International Journal of Comparative Education and Development. 2016;23(2):81-103. doi: 10.1108/IJCED-11-2020-0081.
27. Chin JMC, Ching GS. Trends and indicators of Taiwan's higher education internationalization. The Asia-Pacific Education Researcher. 2009;18(2):185-203. doi: 10.3860/taper.v18i2.1322.
28. Chen C, Mun CT, Wen D, Weng L, Yu Z. The survey and evaluation indicators for internationalization of research universities in China. Peking University Education Review. 2009;4:116-35.
29. Shamsi Gooshki E, Pourabbasi A, Akbari H, Rezaei N, Arab Kheradmand A, Kheiry Z, et al. Internationalization of medical education in Iran: A way towards implementation of the plans of development and innovation in medical education. J Adv Med Educ Prof. 2018;6(1):43-8. [PMID: 29344529] [PMCID: PMC5757156]
30. Pouratashi M. Internationalization mechanisms in world selected universities and Iran. Quarterly Journal of Research and Planning in Higher Education. 2018;24(2):85-108. [In Persian]
31. Salajegheh A, Farajollahi M, Moosapur N, Sarmadi M. Explain and Validate the Components and Indicators of Internationalization of Virtual Colleges. Educ Strategy Med Sci 2017; 10(6): 526-41. [In Persian]
32. Wan CD. Developing Holistic Indicators to Promote the Internationalization of Higher Education in the Asia-Pacific. Education Policy Brief. Bangkok: UNESCO Bangkok; 2018.
33. Chang D-F, Lin N-J. Applying CIPO indicators to examine internationalization in higher education institutions in Taiwan. International Journal of Educational Development. 2018;63: 20-8. doi: 10.1016/j.ijedudev.2017.12.007.
34. Eriçok B, Arastaman G. Understanding the Internationalization of Higher Education in Turkey: The meaning and Current Policies. International Online Journal of Educational Sciences. 2022;14(4):1107-24.
35. Maneshgar M, Fathi Vajargah k, Hamidifar F. Presenting a Model of Internationalization in Universities and Higher Education Institutions Located in Free Zones. Journal of Educational Planning Studies. 2021; 10(19): 23-1. doi: 10.22080/eps.2022.22437.2068.
36. Ali Khorsandi T, Talatolsharieh F. Conditions for Internationalization of Universities by Focusing on Intercultural Curriculum Planning. Journal of Higher Education Curriculum Studies. 2018;9(18):7-44. [In Persian]
37. De Wit H. Evolving Concepts, Trends, and Challenges in the Internationalization of Higher Education in the World. Voprosy obrazovaniya/Educational Studies Moscow. 2019; 2: 8-34. doi: 10.17323/1814-9545-2019-2-8-34.
38. Fleacă E. Core processes roadmap to deploy the higher education institution's internationalization strategy. TEM Journal. 2017;6(1):85-92. doi:10.18421/TEM61-12.
39. Giralt M, Betts A, Pittarello S, Stefanelli C. Scenarios for the Integration of Virtual Exchange in Higher Education. Journal of International Students. 2022;12(S3):116-34. doi: 10.32674/jis.v12iS3.4629.
40. Hauptman Komotar M. Global university rankings and their impact on the internationalisation of higher education. European Journal of Education. 2019; 54(2): 299-310. doi: 10.1111/ejed.12332.
41. Markovic N, Bokonjic D, De Lepeleer G. Development and implementation of internationalization in Bosnia and Herzegovina higher education. International Journal of Educational Management. 2021; 35(6): 1263-76. doi: 10.1108/IJEM-01-2021-0002.
42. Mittelmeier J, Rienties B, Gunter A, Raghuram P. Conceptualizing Internationalization at a Distance: A "Third Category" of University Internationalization. Journal of Studies in International Education. 2020; 25(3): 266-82. doi: 10.1177/1028315320906176.
43. Movahed E. Internationalization Roadmap of the Universities of Medical Sciences. Educational Development of Judishapur. 2020;11(1):36-48. doi: 10.22118/edc.2019.199456.1138. [In Persian]
44. Myhovych I, Kurylo V. Internationalisation of higher education based on lean management principles: case study of jagiellonian university. Advanced Education. 2021; 19: 42-50. doi: 10.20535/2410-8286.222814.
45. Neria-Piña L. Internationalization of Higher Education in Universities in the Global South during COVID-19: A Case Study of a Mexican University. Journal of Comparative and International Higher Education. 2022;14(3b):77-93.

46. Rozhenkova V, Rust VD. Internationalization of Higher Education in Russia: Aiming for Global Recognition. In: Zajda J, editor. Globalisation and Education Reforms: Paradigms and Ideologies. Dordrecht, Netherlands: Springer; 2018: 93-106.
47. Musavi T, Navehebrahim A, Araste H, Abdollahi B. Designing the Triple Strategies for Internationalization of Selected Iranian Public Universities. Journal of Research in Educational Systems. 2020;14(50):97-126. doi: 20.1001.1.23831324.1399.14.50.6.7.
48. Woicolesco VG, Cassol-Silva CC, Morosini M. Internationalization at Home and Virtual: A Sustainable Model for Brazilian Higher Education. Journal of Studies in International Education. 2022;26(2):222-39. doi: 10.1177/10283153221076898.
49. Edalatian Shahriyari J, Ghasemzadeh F, Mohammadi M. Explain and design the process of internationalization of Iranian higher education with a mixed approach. Sociology of Education. 2021;7(1):217-29. doi: 10.22034/ijes.2021.531766.1069. [In Persian]
50. Ghasemzadeh F, Edalatian Shahriari J, Mohammadi M. Designing Model for the Internationalization of Iran's Higher Education (Case Study: One of the University Payam-E-Nour Branch's in Georgia). Journal of Islamic Life Style Centeredon Health. 2019;3(3):145-62. [In Persian]
51. Jafari S, Rahimian H, Abbaspour A. Designing and Validating a Model for Internationalizing Iranian Universities in Social Sciences and Humanities. The Journal of New Thoughts on Education. 2020; 16(3): 27-48. doi: 10.22051/jontoe.2020.26655.2704. [In Persian]
52. Sahasrabudhe S, Shaikh N, Kasat K. Internationalisation of higher education - Necessity to adapt to new forms of engagement for ensuring sustainability? Journal of Statistics and Management Systems. 2020; 23(2): 431-44. doi: 10.1080/09720510.2020.1736328.
53. Salimi G, Mohammadi M, Nesar Z. Exploration of the faculty member's experiences about the competencies and dynamics of teaching and research in the internationalization of higher educati on process: A qualitative research. Journal of Research in Teaching. 2017;5(2):109-33. [In Persian]
54. Arefi M, Azizi A. Feasibility Study of The Internationalization of Public Universities in Tehran (Case Study of Shahid Beheshti University & Tehran University). Strategic Studies of public policy. 2018;8(26):41-63. [In Persian]
55. Valimoghaddam Zanjani S, Damirchili F, Zolghadr M. The Role of Faculty Members in the Internationalization of Medical Universities of Iran. Journal of Medical Education and Development. 2020;15(1):3-14. doi: 10.18502/jmed.v15i1.3322. [In Persian]
56. Behjati Ardakani F, Yarmohamadian M. Comparative studying internationalizing high education in different countries of the world and presenting proper model in Iran. Journal of New Approaches in Educational Administrations. 2018;9(3):1-18.
57. Romani-Dias M, Carneiro J, Barbosa AdS. Internationalization of higher education institutions: the underestimated role of faculty. International Journal of Educational Management. 2019; 33(2):300-16. doi: 10.1108/IJEM-07-2017-0184.
58. Hamidifar F, Yusoff K, Ebrahimi M. Leadership and management in the internationalization of higher education. Quarterly Journal of Research and Planning in Higher Education. 2017;83(1):49-71. doi: 10.11113/umran2017.4n1-1.204.
59. Saniejlal M. Internationalization of Research Institutes in Iran: A Study of Trends and Prospects. Socio-Cultural Strategy. 2021;10(1):99-126. [In Persian]
60. Morphew C, Hartley M. Mission Statements: A Thematic Analysis of Rhetoric Across International Type. The Journal of Higher Education. 2006;77(3): 456-71. doi: 10.1080/00221546.2006.11778934.
61. Racine N, Villeneuve PY, Thériault M. Attracting Foreign Students: The Case of Two Universities in Québec. Journal of Studies in International Education. 2003;7(3): 241-52. doi: 10.1177/1028315303254428.
62. Fathi Vajargah K, Arefi M, Zamani Manesh H. Evaluating Admission Barriers of Foreign Students into Universities and Institutions of Higher Education. Quarterly Journal of Research and Planning in Higher Education. 2012;17(4):65- 80. [In Persian]

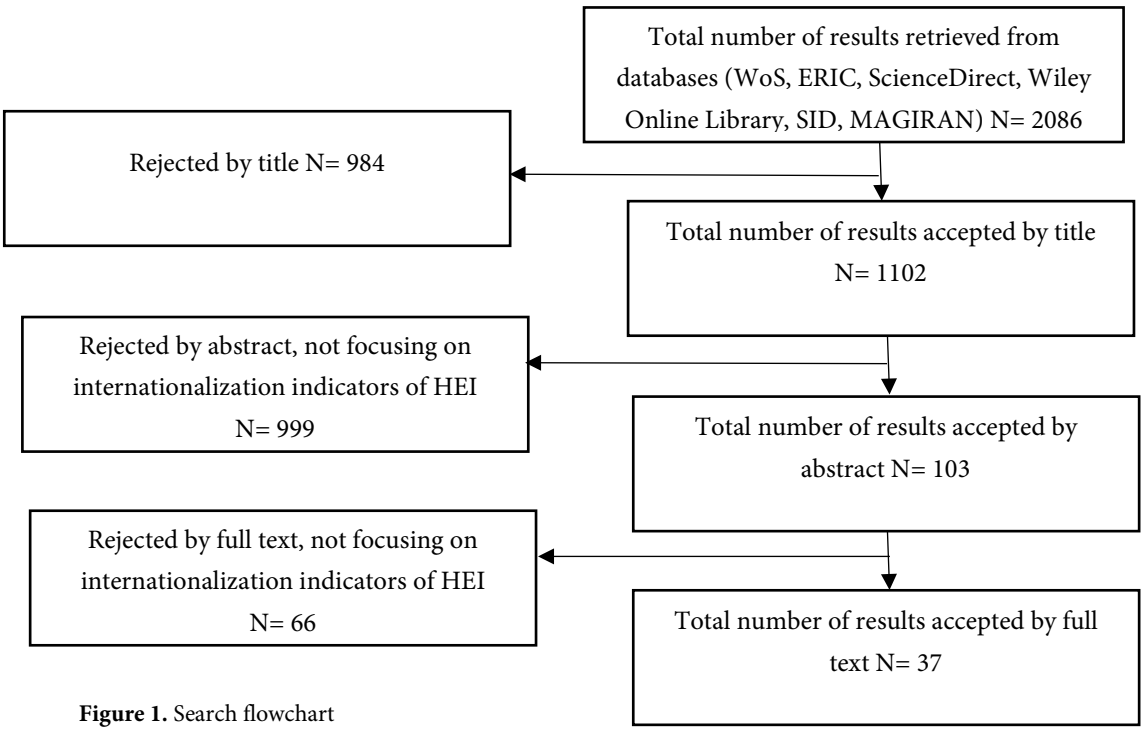

Figure 1. Search flowchart

Table 1. Summary of the reviewed studies

Author(s), Year	Study Type	Participants	Sample Key Findings
E. Movahed Kor, 2020 (43)	Interview	Internationalization executers, educational executers, and research executers	The interview content was categorized into 3 groups: SWOT analysis, subject/scopes (goals and preliminary actions), and actions/plans (development of academic affairs at the international level and explanation and development of international cooperation).
F. Hamidifar et al., 2017 (58)	Interview	International affairs directors and international branch deans	Internationalization of higher education and its distinction with globalization, effective management, and leadership, studying the environment and its impact on internationalization, program implementation, monitoring, and evaluation.
F. Behjati Ardakani et al., 2018 (56)	Documentary research	N/A	The model includes theoretical foundations, curriculum components, international research strategies, characteristics of internationalization factors (students and international faculty members), international infrastructure, implementation stages, and system evaluation.
H. Zamanimanesh et al., 2017 (17)	Interview	Academic experts	Infrastructure factors (global and regional conditions, cultural and economic conditions, and political and security conditions); superstructure factors (management and human resources, scientific cooperation, space and equipment, curricula, extracurricular activities, supervision and review, academic culture)
H. Zamanimanesh, 2017 (16)	Survey using questionnaire	Faculty members	Curriculum internationalization categories: Political/ diplomatic, structural/academic, sociocultural, information/ communication, content/educational, motivational/ humane, and equipment/ technological
S. Valimoghaddam Zanjani et al., 2020 (55)	Interview and survey	Faculty members and international relations staff	Components of faculty members role: Individual competence, educational-research activities, empowerment, and mobility
H. Zamanimanesh et al., 2018 (19)	Survey using questionnaire	Faculty members	Important fields: Political, financial, managerial, informational, academic, and cultural fields.
M. Pouratashi, 2018 (30)	Documentary research and AHP	Academic documents and academic experts	Physical feasibility, professional feasibility, institutional feasibility, promotion of university development, realization of upstream goals, and infrastructure feasibility.
S. Jafari et al., 2017 (2)	Interview	Faculty members and academic managers	Exchange of professors, students, and researchers, scientific and research interaction and cooperation, education and research and international services, exchange of knowledge and theory, creation of international culture, attraction of elites, income generation, and competition.
M. Arefi et al., 2018 (54)	Documentary research	N/A	New technologies, English language, international scientific-educational cooperation, and international research cooperation
F. Ghasemzadeh et al., 2019 (50)	Interview	Managers and students	Causal: Cultural, social, and economic; strategies: Academic and organizational; intervening: Administrative and support and service; background: Political and financial infrastructure, equipment and facilities; consequences: International communication and educational and teaching
G. Salimi et al., 2017 (53)	Interview	Faculty members	Teaching competencies: Up-to-date knowledge, English language, new technology in teaching, developing specialized knowledge, acquisition capabilities and improving, cyberspace in teaching, scientific motivation, specialized knowledge, professional development, time management, several languages, expert student, valid education, discipline

			in teaching, up-to-date resources, responsibility, and commitment. Research competence: Global knowledge, English scientific works, applied research findings, global research reputation, scientific cooperation, scientific and research ability, and the effectiveness of published works.
H. Zamanimanesh et al., 2019 (15)	Interview and survey	Faculty members	International scientific cooperation; international extracurricular activities; organizational strategies; supportive strategies; human recourse development; internationalization of curricula; background conditions; monitoring and evaluation; and international opportunities.
M. Saniejlal, 2021 (59)	Documentary research	N/A	Internationalization in the institution's documents, the organization in charge of internationalization, internationalization budget line, and history of internationalization
H. Zamani et al., 2018 (18)	Interview	Academic experts	International curriculum, international human resources, international organizational structure, international extracurricular activities, international scientific cooperation, international opportunities, and process evaluation and review.
E. 29. Shamsi Gooshki et al., 2018 (29)	Review of literature	N/A	Education in the international arena (international students, international faculty, training graduates who have scientific, industrial and economic guidance, active participation in overseas education, establishment of international branches of universities abroad); scientific productions (writing articles, writing books, managing top global journals, translating knowledge, turning scientific findings into practical concepts); scientific leadership (new scientific concepts, scientific authority, scientific structures, guiding scientific associations and international companies)
J. Edalatian Shahriyari et al., 2021 (49)	Interview (faculty members) and survey (students)	Faculty members and students	Organizational: Strategic plans in higher education, resources to promote international activities and standards, accelerating international participation, university reputation, and the opportunity to attract international elites. Academic: Online and virtual education, up-to-date laboratory equipment, internationalization of higher education as a priority, international research collaborations, international conferences and seminars, and international scientific associations.
A. Khorsandi Taskoh et al., 2018 (36)	Survey and interview	Faculty members	Educational classes with group teaching method, student mobility, international students, joint courses, curriculum planning with the approach of developing citizenship behavior, curriculum planning with the approach of peace between nations and mutual understanding of nations, curriculum planning compatible with the social culture of international students, curriculum planning suited to the cultural needs of international students, teaching in English, educational resources and curriculum based on the development of intercultural understanding, sabbatical leave regulations, extra programs based on the interaction of local and international students, development of language and intercultural communication skills, communication and linguistic knowledge enhancement of academic staff, scientific and social life environment
T. Musavi et al., 2020 (47)	Interview	Academic experts and managers	Educational: International joint training courses; empowering professors and students for international activities; international professors and students; internal and external lectures and workshops; international educational and curriculum programs; international teaching and learning methods; up-to-date and international teaching and library resources; international virtual education; international schools. Research: International joint research projects; international scientific productions; publications with international citation, research grants; national and international conferences; international awards and recognitions, exchange of domestic and international postdoctoral students/researchers; research assistant; international research center; Service: Leadership development and international management; academic quality and performance in accordance with international standards; international communication and cooperation; active membership in international scientific associations; active membership in international scientific databases; international professors, Iranian professors living abroad;

			entrepreneurship and inventions, patents and international entrepreneurial companies; motivational mechanism of international activities
M. Romani-Dias et al., 2019 (57)	Review of literature and in-depth interviews	Permanent researchers from Brazilian master's and doctoral programs in Management	The researchers' international academic experience; insertion in international collaboration networks; international co-authorship and experience in international publications. Visiting professors, advisory positions, and examining boards in foreign institutions, international academic events, and academic awards obtained abroad. International study groups, editorial staff and reviewer of journals, scientific congresses
V. Rozhenkova et al., 2018 (46)	Documentary research	N/A	International scientific cooperation, international scientific community; international scientists and specialists; international collaboration in research, technology, and innovations; and joint research with international organizations, holding degrees from such distinguished Western universities; publishing in the leading international journals; an international advisory board, academic decisions, oversee the academic activities and responsible for all academic appointments and promotions, English language instruction, inter-institutional collaborations; joint research ventures and study courses; two-sided and multi-sided exchange programs; dual-degree programs, collective scholarly publications
MH. Komotar, 2019 (40)	Review of literature	N/A	THE ranking: International-to-domestic student ratio, international-to-domestic staff ratio, and international collaboration. QS ranking: International faculty ratio and international student ratio. U-MultiRank: International orientation of BA and MA programs, study abroad, international doctorate degrees, international joint publications, international research grants, foreign language BA programs, student mobility, international academic staff, international doctorate degrees, international joint publications, foreign language MA programs, and international orientation.
N. Markovic et al., 2021 (41)	Survey	Students and management	Study programs in English, joint study programs, internationalization of the curriculum, strategic partnership with foreign institutions, mobility of non-academic staff, international research activities, international networks of higher education, summer school, bilateral or multilateral international cooperation, international development projects, capacity building, mobility of student/ teaching staff.
E. Fleaca, 2017 (38)	Documentary research	N/A	International mobility of students/ staff, internationalization and improvement of curricula and new e-learning methods, strategic cooperation, partnerships and capacity building with stakeholders
V. Kurylo et al., 2021 (44)	Documentary research	N/A	MoU: Bilateral Memoranda of Understanding (MoU); student mobility, Quin Jadwiga Fund funding scheme, Erasmus / Erasmus+ Program, staff mobility
H. de Wit, 2019 (37)	Review of literature	N/A	International students, international faculty, international mobility of faculty, internationalization at home, internationalization of the curriculum, teaching and learning, learning outcomes and global citizenship development, internationalization of research, international co-authorship and other international research benchmarks, international rankings, international research funding, patents, publications and citations, scientific collaboration with the international scientific community, international branding, reputation, and rankings
S. Sahasrabudhe et al., 2020 (52)	Delphi	Experts	Online teaching, co-taught courses with international partners, policies for promoting internationalization, curriculum internationalization workshops, international seminars, collaborative joint research, virtual classrooms, incorporating international and comparative aspects into teaching, campus diversity, international faculty for academic engagement, agreements (MoU)

J. Mittelmeier et al., 2021 (42)	Review	N/A	Movement of education across national borders (students, staff, and programs), curriculum internationalization, various online communication platforms, online discussion forums, informal Facebook groups, language-learning partners in different countries, online group work tasks between campus-based students in different countries, and virtual teams among students in two different countries
Y. Watabe et al., 2021 (26)	Questionnaire and round table discussion	Academic and administrative staff at the International Affairs Office	Strategy and governance (SG), student and staff characteristics (SSC), education and learning (EL), student services (SS), research (R), and quality assurance (QA)
A. Salajegheh, 2017 (31)	Survey and questionnaire	Administrative staff and policymakers	Research, student, faculty, curriculum, engagement, and governance
S. Jafari et al., 2020 (51)	Interview and survey	Faculty members and students	Internationalization at home (awareness, formation of intercultural atmosphere, attraction of international professors and students); international curriculum (international curriculum content, curriculum in an international language); and internationalization abroad (establishing a university branch and offering virtual education)
B. Eriçok et al., 2022 (34)	Documentary research	N/A	Sub-dimensions of education/ training, institutional quality, research/ publication, and human resources; cultural meanings in the sub-dimensions of cultural ambassador, diversity, and integration; political meanings in foreign policy, soft power, political closeness sub-dimensions and, finally, economic meanings in the sub-dimensions of human resources, growth, global competition, and economic mobility
L. Neria-Piña, 2022 (45)	Semi-structured interviews	Staff at the International Affairs Office	Focusing on internationalization at home strategy through growing intercultural knowledge and competencies in students, mobility programs, organizing webinars and virtual conferences; collaboration through networking, leveraging strategic partners through student and faculty mobility, and joint research; tapping on technology to strengthen virtual mobility; and involving professors through guidelines for them to integrate an international component into their courses.
VG Woicolesco, et al., 2022 (48)	Semi-structured questionnaire	Brazilian HEIs	Virtualization will continue after the pandemic; virtualization of internationalization at home contributes to the sustainability of internationalization.
M. Giralt, et al., 2022 (39)	Documentary research and survey	Virtual exchange practitioners and coordinators	Virtual exchange as a preparatory or follow-up activity to physical mobility (blended mobility); virtual exchange as an intertwined component of physical mobility (blended mobility); virtual exchange as a stand-alone learning activity; virtual exchange as a component of a course.
DF Chang, et al., 2018 (33)	Survey and questionnaire	Faculty members and students	Indicators were classified into Context (international students), Input (setting up international affairs offices, investing in required staff in the international affairs offices, strategic plan for internationalization, monitoring the process of internationalization, funding for promoting internationalization), Process (establishing overseas branch campuses, establishing distance-learning programs, promoting international research cooperation, endorsing internationalization-related courses, promoting international learning activities, international student recruitment, and international internship accreditation); and Outcome (outbound students, international students on campus, foreign staff on campus, international cooperation programs, articles published in international journals, papers in international conference proceedings); dimensions according to CIPO model.

M. Maneshgar, et al., 2021 (35)	Semi-structured interviews	Faculty members and students	Management and human resource (recruitment of international students/ professors, exchange of students and professors, competent human resource, training international managers); structural and organizational (planning, organizational support, organizational structure); economic and financial (commercialization of education and research, generating income from the internationalization); cultural and social (global citizen training, intercultural understanding); educational and research (establishing joint universities & branches, holding international conferences and congresses, use of new educational technologies); communication and information (collaborative and joint research projects, educational interactions with foreign counterparts, publication and printing books and research articles in international languages); political and governmental (foreign policy and diplomatic relations); global and regional (strategy for internationalization, compliance with global standards).

SWOT: Strengths, Weaknesses, Opportunities, and Threats; HEIs: Higher education institutions; QS: Quacquarelli Symonds; THE: Times higher education; BA: Bachelor; MA: Master; CIPO: Context-Input-Process-Output

Table 2. Themes, sub-themes, and sample codes

Theme	Sub-themes	Sample Codes
Educational Affairs	Internationalization at a distance	Analysis and planning for internationalization at a distance, virtual and online teaching and training, using different online communication platforms, using discussion forums and informal social media groups, defining online group work assignments between students from different countries, forming virtual teams between students from different countries to implement joint educational activities, virtual exchange/ mobility, monitoring and promoting internationalization programs at a distance
	Quality assurance and continuous improvement of internationalization	Analysis and planning for quality assurance of internationalization activities, internal evaluation of the quality of university internationalization/ curriculums, external evaluation of the quality of university internationalization/ curriculums, getting advice from experts and continuous quality improvement, monitoring and promotion of internationalization quality assurance programs
	Internationalization of education, teaching, and learning outcomes	Analysis and planning for the internationalization of education, internationalization of the curriculum, providing study abroad opportunities, admission of international applicants, participation in exchange projects, creation of joint degrees/ courses, creation of international degrees/ courses, participation of international professors in academic activities, using new electronic methods in teaching and learning, learning foreign languages, international presence of graduates, monitoring and promotion of educational internationalization programs
International Relations	International public relations and communication	Analysis and planning for international networking, and international public relations and communications, developing a strategy for internationalization of public relations, creating/ updating the university website in English, active presence in common online social networks in English, marketing through advertising, online social networking, and brochures, promoting university branding program, introducing scientific capabilities of universities to other countries, introducing professors' ability and research interests to attract foreign postdoctoral students, notification of foreign opportunities, advertising in international educational magazines/ newsletters, monitoring and promotion of networking, international public relations and communication programs
	International cooperation and networking	Analysis and planning for internationalization of academic collaborations, the conclusion of a memorandum of understandings, performing international visits, networking and development of relations, formation of university/school internationalization committee, holding international events, the establishment of international campuses/branches, participation in international ranking systems, monitoring and promotion of international cooperation programs

Research Affairs	Internationalization of research	Analysis and planning for the internationalization of research, establishing an open research system, creating an attractive research system, creating new research capacities, conducting applied research, conducting international research benchmarks, authoring internationally cited research achievements, obtaining better understanding of indigenous knowledge and its introduction to the world, establishing joint research collaborations, creation of joint databases in research fields, compliance with international standards in joint research, compliance with international ethics in publishing articles, authoring international publications, obtaining international research grants/ funds, having international patents, holding international research events, providing access to bibliographic databases, publishing in reliable international publications and journals, having high quality and up-to-date resources in libraries, having internationally operated research centers, monitoring and promoting research internationalization programs
	Commercialization of ideas and innovations	Analysis and planning for commercialization of ideas/ innovations, increasing the university's dedicated income through commercialization, commercialization of education and research, launching knowledge-based companies and international start-ups, scientific and research marketing, considering higher education as an industry, monitoring and promoting commercialization of ideas and innovations
Student Affairs	Student welfare/support services	Analysis and planning for the internationalization of student welfare/support services, providing the information needed by foreign students before and immediately after arrival, providing a variety of services for registered international students, facilitating interaction between international and domestic students, monitoring and promotion of internationalization programs for student welfare/ support services
	Cultural/ social services	Analysis and planning for the internationalization of culture/ society in the university, spreading multiculturalism in the university, promoting the learning of social behaviors, promoting respect for cultural differences, developing intercultural communication skills, organizing international cultural festivals, providing an attractive and stimulating cultural and social environment for international students, expanding the culture of hospitality in the university to attract international students, increasing flexibility in facing other cultures in the university to attract international students, a positive view of the presence of foreign professors and international students in the university, the flexibility of professors to the teaching of foreign professors, monitoring and promotion of culture/ community internationalization programs
Management and Human Resources	Management	Analysis and planning for the internationalization of management, reflecting internationalization in the vision/ mission of the university, developing university internationalization strategy, reflecting internationalization in the leadership and management of the university, having a robust organizational structure for internationalization, developing strategic planning, having proper infrastructure based on international standards, having a dedicated budget for internationalization, monitoring, and promotion of management internationalization programs
	Human resources	Analysis and planning for the internationalization of human resources, recruitment and appointment of international staff (academic and administrative), empowering staff (academic and administrative) in terms of international competencies, monitoring, and promotion of human resources internationalization programs
Healthcare and Treatment	healthcare and treatment	Analysis and planning for the internationalization of healthcare services, establishing health/ medical tourism, equipping affiliated hospitals with modern medical equipment, monitoring, and promotion of internationalization programs of health and medical services

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Review Article

A Scoping Review of the Reasons and Strategies to Manage Health Workforce Migration in Iran

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Abstract

Background: Health workforce migration (HWM) is a long-standing and increasing phenomenon in low and middle-income countries. If adequately managed, mobility and migration of health workforce from these countries facing health worker shortages can strengthen their health systems and widen equities.

Objectives: This scoping review aimed to understand the reasons for and approaches to managing HWM in Iran which could have potential applications in other contexts.

Methods: The inclusion criteria of this scoping review consisted of studies reporting HWM in Iran. In November 2023, PubMed, the Web of Science, Scopus, SID, and Magiran were searched. Searches were limited to Persian and English reports published without a time limitation. We followed the PRISMA protocol for scoping reviews. Data were extracted and charted.

Results: Searches identified 5,661 articles. A total of 40 original articles met the inclusion criteria and were included after the screening. Overarching themes related to the review questions were: (1) Reasons for health workforce mobility and migration (three themes including *Governance,* Social domain, and Social scope), and (2) strategies to address HWM at the national level (three themes including *Governance-structural strategies, Educational and academic strategies, Individual-social strategies*).

Conclusion: HWM is a complex and multifaceted phenomenon often driven by a range of push and pull factors at the individual, institutional, community, and policy levels. This research can serve as a foundation for future work aiming to implement interventions to minimize the negative consequences of HWM and promote workforce sustainability in Iran or other developing countries.

Keywords: Health Workforce, Migration, Brain Drain, Iran

Background

Brain drain or elite migration is one of the most severe human capital challenges in the world. Indeed, it is the transfer of human resources where the country of origin needs the knowledge and expertise of its elites, but they prefer permanent or semi-permanent migration to other countries (1). Immigrants make up one-seventh of the world's population (2). The migration of people from developing to developed countries is a typical and ongoing process, and many experts and intellectuals decide to leave their countries if they recognize that the country of origin cannot pave the way for actualizing

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their talents (3). Elite and efficient human resources play a vital role in various national fields and are considered one of the most critical assets of any country or organization (4). Elite migration causes severe damage to the country and leads to a shortage of professionals in different fields. It also disrupts the meritocratic system managing of the country of origin. Moreover, host countries exploit the academic and occupational competencies of elites migrating to these countries (3).

Human resources are the most critical input of the healthcare system and play a vital role in providing healthcare services. However, less attention has been paid to the importance of human resources in the healthcare sector of developing countries (4). Health workforce migration (HWM) from countries affects the health and welfare of the community as well as restricts residents' equal access to healthcare services. According to the World Health Organization (WHO, 2006), there was a shortage of 3.4 million healthcare workers, and it is estimated that this shortage will reach 18 million people by 2030 (5). HWM restricts the access to and quality of healthcare services. Moreover, the diminished number of healthcare staff, especially in rural areas, leads to a disruption in service provision and delivery, more dissatisfaction, the resignation of other staff, increase in the waiting time of patients, elevated treatment costs, and loss of active population (4).

Evidence suggests that Iran is among the countries with a high level of HWM. A report released by the World Health Organization (WHO) in 2017 revealed that Iran is ranked seventh in the world in terms of the number of immigrant doctors. Many immigrants are specialists and graduates of various fields of medical sciences, including general practitioners, holders of specialized and sub-specialized degrees, dentists, pharmacists, and other professionals with doctorate degrees in related sciences. According to the assessment of the Iran Medical Council (IRIMC), every year, about 400 general practitioners and 300 to 350 specialists migrate from Iran (5, 6).

Variables such as political defects, payment differences, inadequate research facilities, family issues, children's education, and work-related rewards are among the possible factors that can encourage students from third-world countries to leave their homelands (7). In general, the deterrents of the country of origin include economic-occupational, cultural-social, political-religious, educational-academic, and personal factors that cause the medical community to be dissatisfied with the government, while attractive factors such as legality and regulations, the sense of security, welfare, and material facilities, as well as job and educational opportunities in the destination country would motivate many medical specialists to migrate to the destination country (2).

The Global Commission on International Migration (GCIM) reported the effects of migration on development. It recommended that the analysis of international migration should be an integral part of national, regional, and global strategies for economic growth in developing and developed countries. According to the GCIM report, the immigration of elites can be an opportunity to create and use their potential to the maximum (8). Since efficient and elite human resources play the most crucial role in the developing any country by employing their tactfulness and resource management, their optimal management is considered very important. Due to their potential, elites have an undeniable role in changing the structure of systems, driving changes, and developing the community. Thus, there is a need for a paradigm shift from traditional human management to new management with a focus on elites (4). New management practices involve identifying, attracting and guiding, training, employing, supporting, honoring, modeling, and maintaining human capital (9, 10). Given the growing rate of elite migration and the significance of human capital management, the present study sought to examine the reasons and strategies affecting the management of HWM in Iran using a scoping review methodology.

Objectives

This scoping review aimed to understand the reasons for and approaches to managing HWM in Iran which could have potential applications in other contexts.

Methods

This study partially followed the preferred reporting items for systematic reviews and meta-analyses for scoping reviews (PRISMA-ScR) (Supplementary Material). The manuscript was not previously registered in databases such as PROSPERO.

A. Search strategy

The studies were collected through a comprehensive search of the electronic national and international databases, including the Scientific Information Database (SID), Magiran, PubMed, the Web of Sciences, and Scopus. The manuscripts were collected if published before November 2023. A range of keywords were adopted, including "elite migration," "*migration*," "*immigration*," "*brain drain*," and "*Iran*," to encompass as many articles as possible in the review.

B. Eligibility Criteria

No eligibility restrictions were adopted for the methodology or design of the studies. The only inclusion criteria were related to the topic that had to be on the HWM and Iran. We ensured that only original and peer-reviewed articles were included excluding letters to the editor, conference papers, proceedings, or abstracts, while other manuscript typologies were included.

C. Data Sources, Studies Sections, and Data Extraction

Two investigators independently reviewed the results retrieved from electronic databases and performed the screening. The first step of the screening was the removal of duplicate screenings, which were conducted by title, abstract, and full text. Next, in the second step, the references of the included studies were manually screened to include the review of other studies on this topic. Finally, the main results were summarized in a table. It included information related to the year of publication, journal, study methodology, and the main findings. The results were analyzed and discussed thematically. MAX-QDA was used for the analysis.

Results

A total of 5661 articles (Pub Med: 507, Web of Science: 4002, Scopus: 101, SID and Magiran: 1051) were searched and extracted from scientific databases. After removing duplicates and irrelevant articles, 40 full-text articles were used in the final analyses. The screening process is presented in (Figure 1).

Characteristics of included studies

The studies used in this article were from 1998 to 2024. The number of studies from 2005 to 2024 was 40 articles and the number of descriptive articles was 14 (6, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22); the number of qualitative articles was 10 (4, 5, 8, 23, 24, 25, 26, 27, 28, 29); the number of cross-sectional articles was 3 (1, 30, 31); the number of case study articles was 1 (32); the number of analytical articles was 2 (2, 33); the number of review articles was 1 (34); the number of qualitative-quantitative articles was 2 (35, 36); the number of qualitative-descriptive articles was 1 (3); the number of survey articles was 3 (37, 38, 39); the number of experimental articles was2 (10,40); and the number of articles qualitative and meta-analysis was 1 (7) (Figure 2) (Table 1).

The subgroups investigated in the studies included elites (7, 10, 20, 24, 21,14, 13, 31, 38) nurses, doctors (3, 29, 26), medical students (16, 34), immigrant women (1) (Sample search strategy can be seen in appendix) (Table 2).

Influential factors in elite migration

Factors affecting stimulation of the migration of elites included the Governance, Social Domain and Social scope, each of which had sub-sets that we have discussed below.

Governance

A review of the selected articles revealed that one of the factors that provoked elite immigration was governance.

Governance involves selection, meritocracy, the rule of law, as well as internal and international relations. Selection and meritocracy are affected by rent-seeking (7), lack of support for and employment of elites, absence of permission to recruit elites (3), lack of context for standard services (11), and absence of meritocracy (10). Moreover, the issues affecting the rule of law include the dominance of political groups over universities (7), weak and unfair laws (3), as well as government monopolies and sanctions (33). Further, the issues related to national and international relations include weak educational research communication and the lack of communication between industry and academic research centers (33).

Social Domain

The most important factors linked to the social domain included the scientific issues faced by the Elites Foundation, as well as educational infrastructure, and economic and welfare problems. The scientific problems faced by the Elite Foundation include lack of performance evaluation, inadequate inter-departmental coordination (23), while educational infrastructure problems such as extended academic program (24), poor scientific guidance (4), failure to foster creativity and thinking (24), and economic and welfare problems including job dissatisfaction, unemployment of graduates with academic education (24), lack of job opportunities in some industrial fields (2), inadequate income (35), low level of economic openness and freedom (25), and lack of financial stability and transparency (30).

Social scope

The social factors affecting elite migration include workplace issues, motivation and vision for the future, and social security. Workplace issues include high-risk workplaces, high workloads (5), and counterproductive workplaces (18). Motivation and vision for the future involve the lack of confidence in the future (3), reduced social dignity and respect for scientists (7), failure to create a happy and dynamic environment for elites (4), and lack of effective programs to motivate and encourage elites (19). Moreover, social security issues include political/social instability (37) and lack of social freedom (4) (Figure 3).

Human capital and elite migration management strategies

The strategies of human capital management and elite migration included *Governance-structural strategies*, *Educational and academic strategies, and Individual-social strategies*, which we have discussed below.

Governance-structural strategies: Previous studies have proposed various strategies for human capital and elite migration management, including reducing bureaucracy, establishing rule-based governance, creating efficient jobs, and reducing intermediation.

Bureaucracy can be reduced by reforming administrative structures, procedures, scientific and executive centers (37), resource management (26), the institutionalization of the participatory management system (17), reducing paperwork in scientific institutions (10), eliminating complex administrative bureaucracy, and guaranteeing contracts (33).

Further, establishing rule-based governance involves adopting stable anti-corruption policies (10), judicial security, and fighting corruption (23). Creating efficient jobs and reducing intermediation requires government support for entrepreneurship (33), improving job security (35), creating a match between the labor market and academic programs (17), increasing job opportunities (12), and enhancing satisfaction (33).

Educational and academic strategies: Previous studies have proposed the most important educational and academic strategies: reforming the educational system's infrastructure, rebuilding university support services, providing financial support, attracting investment, and improving technology. The educational system's infrastructure involves training the future workforce, strengthening the scientific infrastructure (10), and improving the scientific-educational quality (7). In addition, rebuilding university support services includes the execution of support plans (26), establishing student organizations (36), and establishing the department of knowledge translation (24). Financial support involves increasing the research budget (24), providing economic support for elites (31), and providing scholarships to pave the way for the elites' return. In addition, attracting investment includes:

- developing the relationship between industry and universities (10),
- developing the relationship between national and international universities (18),
- creating a dynamic relationship with the community (34),
- establishing cooperation among virtual colleges,
- strengthening e-learning centers at universities (20), and
- taking advantage of the scientific and professional competencies of immigrants (12).

Finally, promoting technology involves improving scientific research competencies (20) and developing research projects using artificial intelligence plus electronic services (34).

Individual-social strategies: The most critical social-individual strategies reported in previous studies included establishing security and emotional support, creating motivation and a sense of belonging to the country, and building trust. Establishing security involves respecting and tolerating dissenting opinions (17), political stability, and non-violence (27). Emotional support involves strengthening ties and strong connections with family and community (40). Further, creating motivation and a sense of belonging to the country involves creating motivation to stay (32), providing facilities for elites (36), and civic participation of elites (30). Finally, building trust encompasses emphasizing property rights (40), applying Iranian material and spiritual power (17), providing adequate information to the public (13), as well as transparency and accountability (36) (Figure 4).

Discussion

One of the most critical issues in Iran is the emigration of intellectual capital and elite migration since expert and efficient human resources are considered the principal components of development in any country. In recent years, the rate of emigration of specialists (also called brain drain) has been growing. This issue is not only specific to developing countries, but more importantly the factors contributing to this phenomenon and how to cope with them should be addressed. According to the present study's findings, more attention should be paid to elite migration as a growing phenomenon to reduce the damage and losses caused by elite migration. Accordingly, a review of the articles published in this field shows that it is necessary to focus on the issues of governance and social and individual problems as factors contributing to elite migration.

Overarching themes related to the review questions were: (1) Reasons for health workforce mobility and migration (3 themes) list items here, and (2) strategies to address HWM at the national level (3 themes) list items here.

Elite migration can be partly attributed to governance issues, including selection and meritocracy, the rule of law, and national and international relations, each with 4, 5, and 3 subcategories, respectively. Similarly, Bang and Mitra reported that the

marginalization of educated and elite people, non-interference of skills and competence in recruiting, tense political atmosphere, and unequal promotion opportunities were critical reasons for brain drain (21).

The data in the present study indicated that social factors such as the Elite Foundation's scientific problems, educational infrastructure, and economic and welfare issues could account for elite migration, each with 3, 2, and 6 subcategories, respectively. A study by Ribeiro et al. in Portugal showed the leading causes of migration were searching for better employment opportunities and obtaining professional development opportunities (32).

The results of the current study indicated that social factors play a significant role in elite migration. These factors include workplace issues, motivation and vision for the future, and social security, each with 4, 3, and 2 subcategories, respectively. In a similar vein, Bange and Mitra reported that the lack of freedom of speech and social security were some reasons for elite migration (21). A review of the investigated articles demonstrated that the focus on governance-structural, educational-academic, and individual-social issues could contribute to formulating human capital and elite migration management strategies.

Accordingly, some governance-structural strategies can mitigate elite migration trends by reducing bureaucracy, creating rule-based governance, creating efficient jobs, and reducing intermediation, each with 6, 2, and 5 subcategories, respectively. A study by Bang and Mitra in the USA also found that political stability, the form of investment, and the quality of the bureaucracy significantly affect the flow of immigration in the USA (21).

The present study observed that educational and academic strategies, including reforming the infrastructure of the educational system, the reconstruction of academic support services, financial support, investment attraction, and technology promotion, could reduce elite migration, each with 5, 3, 3, 3, and 2 subcategories, respectively. Further, a study by Murakami in Japan showed that the availability of an excellent research environment, development of science and technology, abundant funding, high-quality facilities, diversity of human resources, the existence of an opportunity for free discussion, and reduced responsibility for doing various tasks were some factors affecting immigrants' decision to return to the homeland (22).

Crucially, our research underscores the importance of individual-social strategies in mitigating brain drain. These strategies, which involve ensuring security, providing emotional support, fostering motivation and a sense of belonging, and building trust. Notably, Bang and Mitra's research supports our findings, emphasizing the effectiveness of strategies such as respecting elites' opinions, providing a platform for political expression, protecting property rights, and promoting transparency in reducing elite migration (21).

There was no access to the non-Farsi and non-English papers. One of the weaknesses of the current study was being non-experimental, but its strength its proximity the real situations of society. Note that one of the best and most efficient methods to understand the influential factors on immigration and the strategies to maintain a society is the health care system.

Previous studies have indicated that various factors, including economic, social, cultural, political, and educational issues, can contribute to elite migration.

Conclusion

The present study explored the factors of human capital management strategies and the main factors affecting the tendency of elites to migrate abroad. Thus, Iranian officials need to pay more attention to elite migration and use the Iranians' intellectual and economic competencies abroad to a greater extent. These goals can be achieved if the whole system tries to develop a road map by establishing effective communication with university graduates as well as resolving the problems and issues reported in this study. Further, regarding the current policies governing the country, relevant authorities should reform the repulsive and restrictive policies as well as strengthen the government's approach to the maximum use of elite human resources. Considering the vital role of human resources in countries' health systems, managers should be aware that healthcare staff can play an influential role in promoting community health. Therefore, adopting effective policies, improving communication with experts worldwide, and managing capable immigrants can mitigate the burden of such problems in the country as well as improve the quality of life and work of capable community members. Meanwhile, there is a need for deep and comprehensive field studies on the factors contributing to or hindering brain drain. One of the limitations of the present study was the lack of access to articles in languages other than Persian and English due to the unavailability of language experts. Hence, future review studies need to address elite migration in articles published in different languages.

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References

1. Taherahmadi M, Khabaz Mafinejad M, Sayarifard A, Akbari Sari A, Farahani P. Iranian medical students' tendency to migrate and its associated factors. BMC Med Educ. 2023 Apr 12;23(1):232. doi: 10.1186/s12909-023-04147-x. [PMID: 37046306] [PMCID: PMC10091681]
2. Diba F, Gholipour A, Pourezzat A. A Future-Oriented Analysis of Academic Reverse Migration. Strategy. 2020;29(2):113-37.
3. Vedadhir A, Eshraghi S. Attitude toward migrate abroad in Iranian medical community: a qualitative study. Quarterly Journal of Research and Planning in Higher Education, 2023; 25(2): 23-42.
4. Vahid Dastjerdi M, Soltankhah N, Pasalar P, Hosseini M, Sheikh Al-Islamzadeh M. Challenges and Strategic Priorities of Health Elites. Iran J Cult Health Promot 2021; 5(1): 12-7. [In Persian]
5. Asadi H, Ahmadi B, Nejat S, Akbari Sari A, Garavand A, Almasian Kia A, et al. Factors influencing the migration of Iranian healthcare professionals: A qualitative study. PLoS One. 2018 Jun 27;13(6):e0199613. doi: 10.1371/journal.pone.0199613. [PMID: 29949640] [PMCID: PMC6021092]
6. Alaeddini F, Fatemi R, Ranjbaran H, Feiz Zadeh A, Ardalan A, HosseinPoor A, et al. The inclination to immigration and the related factors among Iranian physicians. Hakim Journal. 2005;8(3):9-15. [In Persian]
7. Zakersalehi G. Meta-analysis of studies conducted in the field of attracting elites and preventing their migration. Iranian Sociological Association Journal. 2016;8(1):81-101.
8. Khosravi AA, Khosravi S, Bidkani MM, Mir S. Elite migration and its relationship to development: Opportunities and challenges for policymakers. Education Strategies in Medical Sciences. 2020;12(6):8-18. [In Persian]
9. Nazemi A, Mousavinasab M, Policy T. Consequences of rethinking in elite concept. Journal of Science and Technology Policy. 2012;5(4):17-33. [In Persian]
10. Shahabadi A, Salehi M. The impact of management improvement abundance of natural resources of channel governance on brain drain. Iranian Journal of Trade Studies. 2017;21(83):103-34. [In Persian]
11. Biglari S, Mayo L, Beynaghi A, Maknoon R, Moztarzadeh F, Mozafari M. Rethinking Iran's brain drain: System dynamics modeling and causal layered analysis to investigate the future behaviors of complex societal issues. Futures. 2022; 135: 102835. doi: 10.1016/j.futures.2021.102835.
12. Shahabadi A, Bozorgi A. The effect of economic, political and civil freedom on migration (By emphasizing on brain drain). Majlis and Rahbord. 2014;21(77):41-69. [In Persian]
13. Hakimzadeh R, Talaei I, Javanak M. The effect of educational, social and cultural factors on the tendency to emigrate from the country in Tehran University students. Journal of Research and Planning in Higher Education. 2014;69:81-102. [In Persian]
14. Eissazade N, Hemmati D, Ahlzadeh N, Shalbafan M, Askari-Diarjani A, Mohammadsadeghi H, et al. Attitude towards migration of psychiatric trainees and early career psychiatrists in Iran. BMC Med Educ. 2021 Sep 22;21(1):502. doi: 10.1186/s12909-021-02926-y. [PMID: 34551745] [PMCID: PMC8459496]
15. Kazemi A, Baghbanian A, Maymand MM, Rahmani H. Contributing factors to migration growth among Iranian students: Drivers of migration to Malaysia. Journal of international migration and integration. 2018;19:757-70. doi: 10.1007/s12134-018-0567-z.
16. Chalabi M, Abbasi R. Comparative analysis of brain drain in micro and macro levels. Journal of Human Sciences. 2004; (41-42): 13-36. [In Persian]
17. Razavi AB. To Present A Two-Way Model For Scientific Elites Brain Drain. Journal of Cultural Management. 2016; 9(30): 33-4. [In Persian]
18. SMohamamdi Alamuti M. Globalization and Brain Drain: Review of Iran's Experiences. Social Welfare Quarterly. 2005;4(15): 209-32. [In Persian]
19. Heidari H, Davoudi N, Talebi F. Macroeconomic and sectoral effects of labor immigration: application of CGE model Â. Quarterly Journal of Research and Planning in Higher Education. 2023;22(4):25-42.
20. Fallahi K, Monavaryan A. A Study on the factors of elites (human capital) immigration and suggesting appropriate strategies to prevent this phenomenon. Knowledge and Development. 2008; 15(24): 103-32. [In Persian].
21. Bang JT, Mitra A. Brain drain and institutions of governance: Educational attainment of immigrants to the US 1988–1998. Economic Systems. 2011;35(3):335-54. doi: 10.1016/j.ecosys.2010.09.003.
22. Murakami Y. Japan's Brain Drain: An Analysis of Japanese Researchers Living in the United States. Japanese economy. 2010;37(2):23-57. doi: 10.2753/JES1097-203X370202.
23. Cheraghi Z, Nedjat S, Pasalar P, Baygi V, Sadat Ahmadi N. The Ideal Status and Expectations of the Gifted and Talented Students: A Qualitative Study. Journal of Qualitative Research in Health Sciences. 2018; 7(4): 395-406. [In Persian]
24. Ghanei rad MA. Uneven Development of Higher Education, Unemployment of Alummni and Elits Immigration. Social Welfare Quarterly. 2005; 4(15): 169-208. [In Persian]
25. Hajian S. (dissertations). Evaluating the Migration Motives and Post-Migration Experiences of Iranian Dental Graduates Who Migrate to Ontario, Canada. Ontario, Canada: McMaster University; 2022.
26. Bolandhematan K, Mohammadi S. Reasons why elites do not immigrate: A representation of professorship identity. Strategy for Culture. 2015;8(31):127-53. [In Persian]
27. Afyouni S, Ghasemi A. Analysis of women's lived experience of migration (The study of women's cross-border migration). Social Sciences. 2019; 26 (87): 155-78. doi: 10.22054/qjss.2020.46305.2146.
28. Shojaeimotlagh V, Valizadeh S, Hasankhani H, Bozorgomid A. Psychological needs, satisfaction and intention to migrate in Iranian nurses: A qualitative content analysis. Iran J Public Health. 2018 Aug;47(8):1201-8. [PMID: 30186793] [PMCID: PMC6123602]
29. Jahanian Najafabadi A, Borhanizad S, Akhavan-Safar A, Barbosa AQ, Da Silva LF. Motivation of International Mobility of Iranian

Students in Portugal. U. Porto Journal of Engineering. 2022;8(1): 51-8. doi: 10.24840/2183-6493_008.001_0006.
30. Salehi T, Mirzaee M, Haghani S, Salehinia N. Assessment of the Relationship Between Intention to Migrate With Workload and a Healthy Work Environment of Nurses. Journal of Client Centered Nursing Care. 2023;9(2): 113-122.
31. Noori Hekmat S, Maleki MR, Baradaran Attarmoghadam HR, Dehnavieh R. Factors Influencing Genius Immigration from Iran University of Medical Sciences Students Point of View. 2010;6(2):181-4. [In Persian]
32. Ribeiro JS, Conceição C, Pereira J, Leone C, Mendonça P, Temido M, et al. Health professionals moving to… and from Portugal. Health Policy. 2014; 114(2-3): 97-108. doi: 10.1016/j.healthpol.2013.05.009. [PMID:23800606]
33. Mosavi S, Ghodsian H. Analyzing the elites emigration and the impacts of preventive policies by using system dynamics. Strategic Management Researches. 2016; 21(59):37-62.
34. Yazdani Z, Saketi P, Karimi F, Yarmohammadian MH. A Study on the Roles of Virtual Networks and Diaspora in Elite Brain Mobility and Circulation: A Mixed Method Study. Interdisciplinary Journal of Virtual Learning in Medical Sciences. 2019;10(3):49-60. doi: 10.30476/ijvlms.2019.45865.
35. Shoghi Lord E, Alizadehsani M, Shirkhodaie M, Arab Kalmeri M. The relationship between employers' brand attractiveness and elites tendency to emigrate: The moderating role of migration possibility. Iranian Journal of Management Sciences. 2019; 14(53): 67-87. [In Persian]
36. Bozorg Zad S, Kazemi Pour S, Ali Mohseni R. Investigation of Socio-Economic Factors Affecting Elite Tendency to Emigrate Abroad. Strategic Studies on Youth and Sports. 2020;19(48):297-322. [In Persian]
37. Javadzade P. The social causes of migration Iranian elite to USA's universities. Journal of Cultural Management. 2015; 28(9): 95-111. [In Persian]
38. Tavakol M, Erfanmanesh I. Synthetic Approach of Sociology of Science to Brain Drain-Relying on Iran. Journal of Science and Technology Policy. 2015;7(2): 83-92. [In Persian]
39. Foroutan Y, Sheikh M. Tendency towards international migration: The case of Ferdousi University's students in Mashhad. Sociology of Social Institutions. 2018; 4(10): 61-79. doi: 10.22080/ssi.2018.1735.
40. Ahadi H, Nademi Y, Khochiany R. Oil rent and brain drain in the OPEC oil exporting countries. Iranian Energy Economics. 2019; 8(30): 1-21. doi: 10.22054/jiee.2019.10485.

Table 1. Characteristics of included studies

Author	Year	Study Typology	Main Objective
Taherahmadi et al. (1)	2023	Cross-Sectional	This study was designed and conducted to investigate the tendency to migrate and the factors affecting it among medical students of the Tehran University of Medical Sciences, Tehran, Iran, in 2019
Diba et al. (2)	2021	Analytical	Prospective analysis of the reverse migration of academic elites
Vadadher et al. (3)	2020	Qualitative-descriptive	Explaining the tendency to migrate abroad among medical community
Vahiddastjerdi et al. (4)	2021	Qualitative	Identifying the challenges and strategic priorities of health elites.
Asadi et al. (5)	2016	Qualitative	Evaluating the factors affecting the migration of specialist human resources in Iran's healthcare system.
Alaaddini et al. (6)	2006	Descriptive	Examining the factors of doctors' migration and the factors related to it
Zakersalehi (7)	2008	Qualitative and meta-analysis	Workforce maintenance based on the theory of attraction and repulsion
Khosravi et al. (8)	2011	Qualitative	There is no need for elites to reside in national borders. Still, it is possible to provide institutional grounds for knowledge to move quickly across borders through elites and to increase their productivity in the network. In the world of knowledge, the national society will also get its share.
Nazemi et al. (9)	2012	Descriptive	Consequences of rethinking in elite concept
Shahabadi et al. (10)	2017	Experimental	Investigating the effect of economic freedom on the migration of elites from other countries Chosen is developing 77G to the United States of America from 1997 to 2009.
Biglari et al. (11)	2021	Descriptive	Rethinking brain drain in Iran
Mosavirad et al. (33)	2016	Analytical	Analyzing various scenarios and their effect on the rate of migration
Cheraghi et al. (23)	2018	Qualitative	The existence of a permanent mechanism based on their demands, expectations, and problems seems necessary to improve the education system.
Ghaneirad (24)	2005	Qualitative	Unbalanced development of higher education
Shoogi et al. (35)	2020	Quantitative and Qualitative	The relationship between the brand attractiveness of Iranian employers and the reduction of elites' inclination for immigration.

Ahadi et al. (40)	2020	Experimental	Investigating the non-linear effects of oil rent on brain drain in OPEC oil exporting countries in the period of 2000-2016
Hajian et al. (25)	2023	Qualitative	Exploring the migration motivations of Iranian dentists who have moved to Canada.
Salehi et al. (30)	2023	Cross-Sectional	Assessing the relationships between migration intention, workload, and a healthy work environment for nurses.
Alamooti (18)	2005	Descriptive	Globalization and migration of elites
Heidari et al. (19)	2017	Descriptive	Examining the relationship between brain migration and the productivity of all economic factors and its effect on the growth of different sectors as well as social welfare
Javadzade (37)	2016	Survey	The social causes of the migration of Iranian elites to American universities
Bolandhemmatan et al. (26)	2016	Qualitative	Why the elite refrain from immigration
Razavi (17)	2006	Descriptive	Presenting a two-way model of migration of scientific elites
Shahabadi et al. (12)	2014	Descriptive	Identifying factors affecting brain drain from Iran to Europe
Bozorgzad et al. (36)	2020	Qualitative and Quantitative	Investigating socio-economic factors affecting the degree of tendency among elites to emigrate abroad
Afyooni et al. (27)	2020	Qualitative	Analysis of women's lived experience of immigration
Noori et al. (31)	2010	Cross-Sectional	Knowing the most important factors encouraging graduates to migrate abroad
Shojaeimotlagh et al. (28)	2018	Qualitative	Identifying the psychological factors that persuade Iranian nurses to migrate, suggesting necessary measures.
Yazdani et al. (34)	2019	Review	Examining the role of brilliant talents and elites in achieving scientific authority and proposing a model for the maximum participation of elites in achieving scientific authority
Fallahi et. al. (21)	2009	Descriptive	Appropriate strategies to reduce elite immigration
Hakimzade et al. (13)	2014	Descriptive	Investigating the impact of educational, social, and cultural factors on the desire of elites to migrate
Bang et al. (21).	2011	Descriptive	Bange and Mitra reported that the lack of freedom of speech and social security were some reasons for elite migration and in the USA also showed that political stability, the form of investment, and the quality of the bureaucracy significantly affect the flow of immigration in the USA, and supports our findings, emphasizing the effectiveness of strategies such as respecting elites' opinions, providing a platform for political expression, protecting property rights, and promoting transparency in reducing elite migration.
Ribeiro (32)	2014	Case study	Ribeiro et al. in Portugal showed the leading causes of migration were searching for better employment opportunities and obtaining professional development opportunities
Murakami (22)	2010	Descriptive	Murakami in Japan found that the availability of an excellent research environment, development of science and technology, abundant funding, high-quality facilities, diversity of human resources, the existence of an opportunity for free discussion, and reduced responsibility for doing various tasks were some factors affecting immigrants' decision to return to the homeland
Eissazade et al. (14)	2021	Descriptive	Exploring the extent and the reasons for migration among psychiatric trainees and early career psychiatrists in Iran.
Jahanian et al. (29)	2022	Qualitative	Investigating the possible causes behind the significant growth of the number of Iranians in Portugal.

Kazemi et al. (15)	2018	Descriptive	Inspecting the reasons why Iranian students choose to immigrate to Malaysia.
Chalbi et al. (16)	2005	Descriptive	Explaining the sociological factors of the phenomenon of labor displacement and the factors affecting it
Tavakol et al. (38)	2016	Survey	Analyzing immigration of elites
Froutan et al. (39)	2018	Survey	the results of this study accord with the pull-push theory of Lee (1966) and provide further evidence to support the United Nations' (2002) studies, suggesting that the tendency of young people towards international migration is mainly associated with more and better occupational and educational opportunities.

Table 2. Sample search strategy appendix

Search number query sort by filters search details results		
11 "((""Brain Drain""[Mesh]) OR (Migrat*[Title/Abstract] OR ""brain drain""[Title/Abstract] OR immigrat*[Title/Abstract] OR emigrat*[Title/Abstract])) AND ((((((""Health Workforce""[Mesh]) OR ""Health Personnel""[Mesh]) OR ""General Practitioners""[Mesh]) OR ""Dentists""[Mesh]) OR ""Pharmacists""[Mesh]) OR (profession* OR practic* OR pharmac* OR dent* OR dotor OR graduat*))) AND ((""Iran""[Mesh]) OR (iran[Title/Abstract]))" Publication Date from 1000/1/1 - 2023/11/29 "((""Brain Drain""[MeSH Terms] OR (""migrat*""[Title/Abstract] OR ""Brain Drain""[Title/Abstract] OR ""immigrat*""[Title/Abstract] OR ""emigrat*""[Title/Abstract])) AND (""Health Workforce""[MeSH Terms] OR ""Health Personnel""[MeSH Terms] OR ""General Practitioners""[MeSH Terms] OR ""Dentists""[MeSH Terms] OR ""Pharmacists""[MeSH Terms] OR (""profession*""[All Fields] OR ""practic*""[All Fields] OR ""pharmac*""[All Fields] OR ""dent*""[All Fields] OR ""dotor""[All Fields] OR ""graduat*""[All Fields])) AND (""Iran""[MeSH Terms] OR ""Iran""[Title/Abstract])) AND (1000/1/1:2023/11/29[pdat])" 119		
10 "((""Brain Drain""[Mesh]) OR (Migrat*[Title/Abstract] OR ""brain drain""[Title/Abstract] OR immigrat*[Title/Abstract] OR emigrat*[Title/Abstract])) AND ((((((""Health Workforce""[Mesh]) OR ""Health Personnel""[Mesh]) OR ""General Practitioners""[Mesh]) OR ""Dentists""[Mesh]) OR ""Pharmacists""[Mesh]) OR (profession* OR practic* OR pharmac* OR dent* OR dotor OR graduat*))) AND ((""Iran""[Mesh]) OR (iran[Title/Abstract]))" Publication Date "(""Brain Drain""[MeSH Terms] OR (""migrat*""[Title/Abstract] OR ""Brain Drain""[Title/Abstract] OR ""immigrat*""[Title/Abstract] OR ""emigrat*""[Title/Abstract])) AND (""Health Workforce""[MeSH Terms] OR ""Health Personnel""[MeSH Terms] OR ""General Practitioners""[MeSH Terms] OR ""Dentists""[MeSH Terms] OR ""Pharmacists""[MeSH Terms] OR (""profession*""[All Fields] OR ""practic*""[All Fields] OR ""pharmac*""[All Fields] OR ""dent*""[All Fields] OR ""dotor""[All Fields] OR ""graduat*""[All Fields])) AND (""Iran""[MeSH Terms] OR ""Iran""[Title/Abstract])" 128		
9 "(""Iran""[Mesh]) OR (iran[Title/Abstract])" Publication Date """"Iran""[MeSH Terms] OR ""Iran""[Title/Abstract]" "72	756"	756"
7 "(((((""Health Workforce""[Mesh]) OR ""Health Personnel""[Mesh]) OR ""General Practitioners""[Mesh]) OR ""Dentists""[Mesh]) OR ""Pharmacists""[Mesh]) OR (profession* OR practic* OR pharmac* OR dent* OR dotor OR graduat*)" Publication Date """"Health Workforce""[MeSH Terms] OR ""Health Personnel""[MeSH Terms] OR ""General Practitioners""[MeSH Terms] OR ""Dentists""[MeSH Terms] OR ""Pharmacists""[MeSH Terms] OR ""profession*""[All Fields] OR ""practic*""[All Fields] OR ""pharmac*""[All Fields] OR ""dent*""[All Fields] OR ""dotor""[All Fields] OR ""graduat*""[All Fields]" "9	623	624
6 profession* OR practic* OR pharmac* OR dent* OR dotor OR graduat* Publication Date """"profession*""[All Fields] OR ""practic*""[All Fields] OR ""pharmac*""[All Fields] OR ""dent*""[All Fields] OR ""dotor""[All Fields] OR ""graduat*""[All Fields]" "9	294	295
5 "((((""Health Workforce""[Mesh]) OR ""Health Personnel""[Mesh]) OR ""General Practitioners""[Mesh]) OR ""Dentists""[Mesh]) OR ""Pharmacists""[Mesh]" Most Recent """"Health Workforce""[MeSH Terms] OR ""Health Personnel""[MeSH Terms] OR ""General Practitioners""[MeSH Terms] OR ""Dentists""[MeSH Terms] OR ""Pharmacists""[MeSH Terms]" "653	191"	191"
4 "(""Brain Drain""[Mesh]) OR (Migrat*[Title/Abstract] OR ""brain drain""[Title/Abstract] OR immigrat*[Title/Abstract] OR emigrat*[Title/Abstract])" Publication Date """"Brain Drain""[MeSH Terms] OR ""migrat*""[Title/Abstract] OR ""Brain Drain""[Title/Abstract] OR ""immigrat*""[Title/Abstract] OR ""emigrat*""[Title/Abstract]" "451	764"	764"
2 "Migrat*[Title/Abstract] OR ""brain drain""[Title/Abstract] OR immigrat*[Title/Abstract] OR emigrat*[Title/Abstract]" Publication Date """"migrat*""[Title/Abstract] OR ""brain drain""[Title/Abstract] OR ""immigrat*""[Title/Abstract] OR ""emigrat*""[Title/Abstract]" "451	762"	762"
1 """"Brain Drain""[Mesh]" Most Recent """"Brain Drain""[MeSH Terms]" 17		

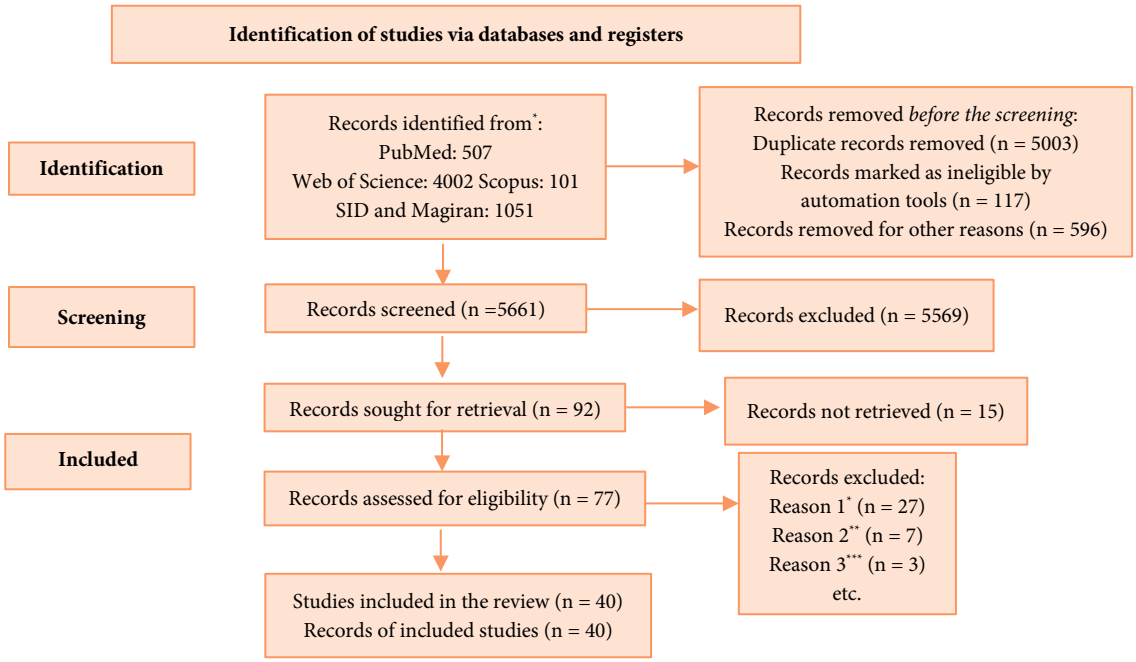

Figure 1. PRISMA 2020 flow diagram
*Failure to mention reasons for migration.
**Failure to mention solutions to tackle the issue of immigration at the national level.
***Lack of access to the full text of the article

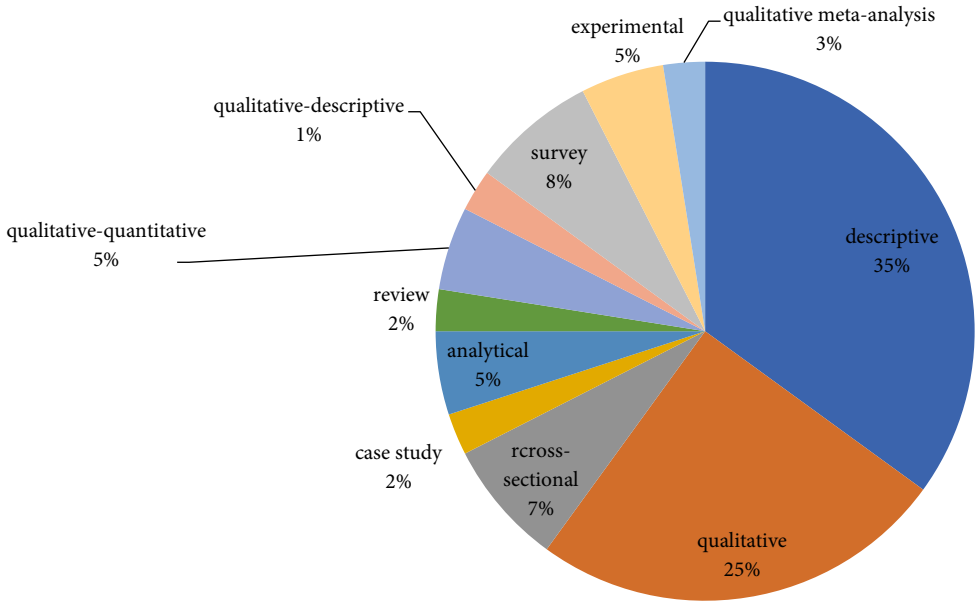

Figure 2. Frequency of included studies by type

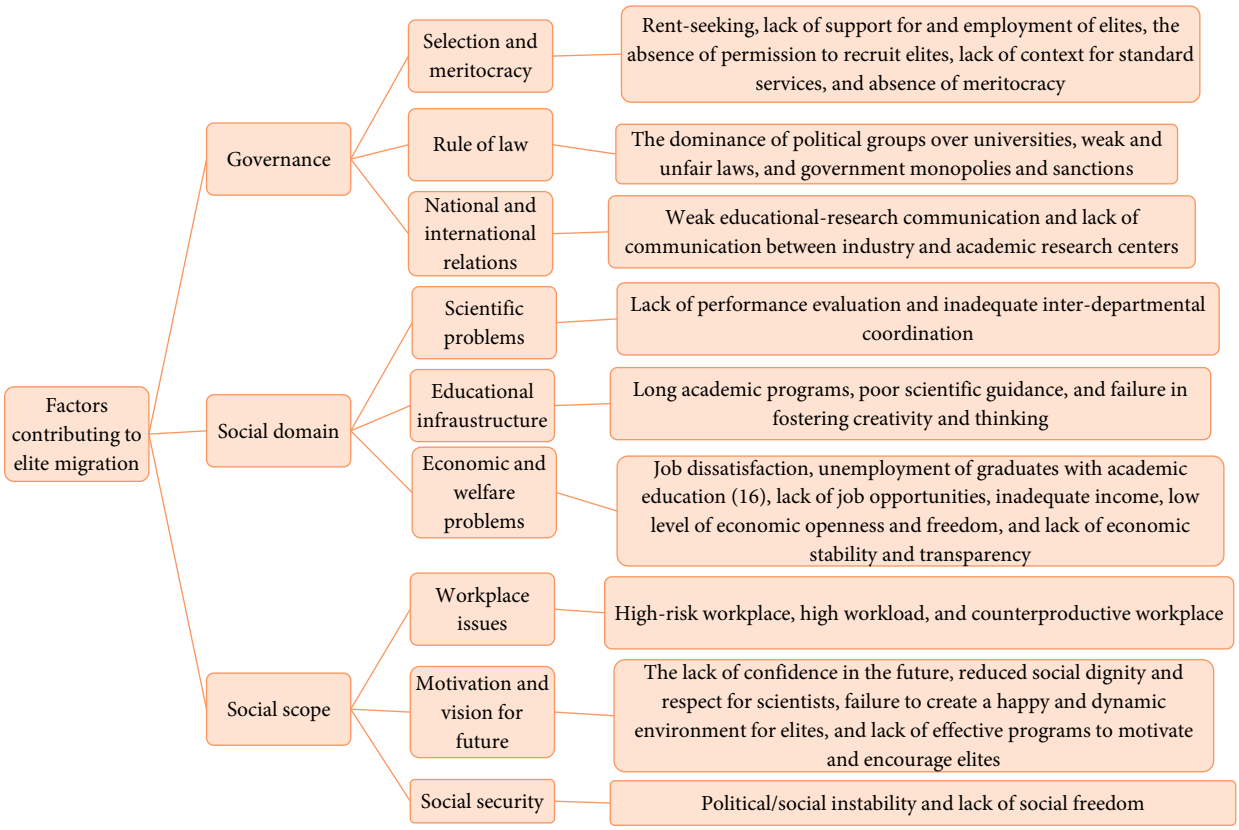

Figure 3. Influential factors in elite migration

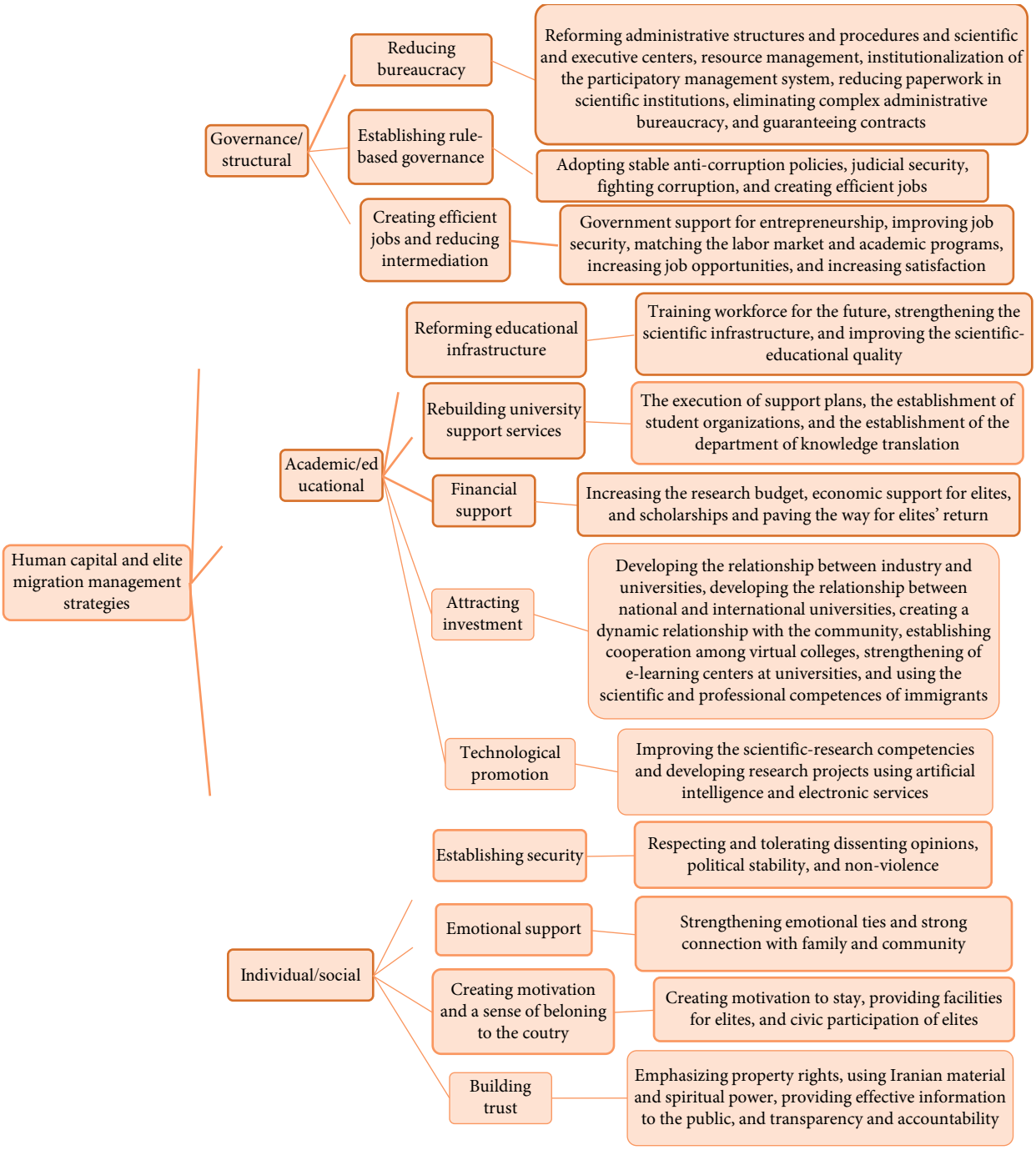

Figure 4. Human capital management and elite immigration strategies

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Original Article

Comparing E-Learning and In-Person Teaching Methods for the Course "Clinical Aspects of Audiology" in Syrian Postgraduate Audiology Students

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Abstract

Background: Due to the lack of studies regarding e-learning in the academic field in Syria, this study was conducted to discuss the importance of e-learning and the probability of developing it. In this study, the researchers compared the effectiveness of traditional learning with e-learning regarding student acceptance of the scientific material and their practical and clinical experiences.

Objectives: Study the efficacy of E-learning compared to traditional in-class learning for the Master of Audiology Students and assess the quality of e-learning as a substitute of traditional ways for post-graduate students.

Methods: In the 2019/2020 academic year at the College of Health Sciences at Damascus University, traditional learning was applied to teach 31 first-year audiology master's students on the clinical aspects of audiology. Subsequently, in the 2020/2021 academic year, e-learning was applied to teach 29 first-year audiology master's students. A comparison was conducted between the two groups to assess student acceptance of the scientific material, their satisfaction with the teaching and evaluation methods using the Exact Fisher test, and the practical and clinical experiences they gained using the t-test to compare the results of their assessments.

Results: No statistically significant difference was observed between the two groups ($P > 0.05$) regarding student acceptance of the subject, teaching methods, and evaluation process. However, students in the e-learning group reported feeling more comfortable dealing with the subject than those in the traditional learning group ($P < 0.05$). Additionally, traditional learning students exhibited a higher motivation level than their e-learning counterparts ($P > 0.05$). No statistically significant difference was found in terms of theoretical knowledge and practical experience gained between the two groups ($P > 0.05$).

Conclusion: Both traditional learning and e-learning methods demonstrated efficacy in delivering scientific material and were well-received by students. Thus, e-learning proved effective as a useful and acceptable learning method in the Syrian academic field.

Keywords: Motivation; Computer-Assisted Instruction; Audiology; Universities; Syria; Students; Personal Satisfaction

Background

Traditional education, which typically involves face-to-face or in-class teaching, has long been a prevalent and effective educational method. Being rooted in live interactions and social communication (1), traditional learning promotes student interaction in shared physical spaces, providing opportunities for interpersonal relationships. The visual and non-verbal cues exchanged during lectures enable communication, allowing immediate feedback on spontaneous inquiries. Additionally, face-to-face interactions enhance student engagement and promote concentration.

The global onset of the COVID-19 pandemic in 2020 profoundly affected education worldwide. Amid uncertainties regarding the disease and its management, educational institutions were compelled to address the

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challenges posed by interruptions to learning. This pandemic underscored the importance of exploring alternative approaches to maintain the educational process, particularly in fields like medical education (2). These unprecedented circumstances provided opportunities for e-learning initiatives to emerge.

E-learning is an innovative approach to acquiring knowledge, skills, and expertise (3). It utilizes various technological tools to facilitate learning anytime and anywhere, tailored to individual preferences (4). This modern educational paradigm leverages technology to augment learning experiences (5).

E-learning is a transformative educational method that originated in the 1980s and has evolved over time to offer enhanced features, accessibility, and global acceptance (6). A key distinction between e-learning and traditional methods lies in social interaction (7). In contrast, traditional settings facilitate direct teacher-student engagement, and e-learning affords flexibility in both timing and location for participation (8,9). Moreover, e-learning capitalizes on multimedia resources for content delivery, unlike the oral delivery typically associated with traditional instruction.

In e-learning environments, learners actively exchange information, fostering collaborative discussions on diverse topics. At the same time, traditional learning is mainly based on the teacher, who is responsible for delivering the learning material (10).

Several studies have explored the differences between e-learning and traditional learning across various aspects of the learning process. In 2009, Congdon and his colleagues (11) undertook a study comparing the academic performance and student experience of two groups of first-year pharmacy students. One group attended in-person lectures at the college, while the other received lectures electronically. Surprisingly, the study found no statistically significant differences between the two groups regarding academic performance and student experience.

In 2018, Almaghasleh (12) conducted a study in Saudi Arabia, revealing that most pharmaceutical students at King Saud University preferred the traditional learning approach and synchronous e-learning over asynchronous e-learning. Similarly, Ronnie's study in 2020 (13) explored the implementation of e-learning for medical students in the Philippines during the COVID-19 pandemic. The study highlighted various obstacles faced by students socially, technically, and personally, as well as factors related to the college they attended.

Paul and colleagues (14) published a study to determine the most effective learning method by comparing academic performance and student experience between e-learning and traditional learning. Although no significant differences were found between the two learning methods, the researchers addressed the importance of enhancing e-learning techniques due to their flexibility and ability to cater to a broader audience of learners.

In the Arab world, the implications of e-learning are still in the beginning stages, and it has not yet gained acceptance from all academic staff and students due to the current modest infrastructure, limited technical capabilities, problematic virtual learning environment, and weak technical skills. Dashash, in 2023 (15), discussed this issue and addressed the importance of e-learning and the possibilities for implementing it in higher education institutions. She also suggested many methods for designing and delivering online education in the Arab world.

Based on the existing knowledge and the lack of studies investigating the effectiveness of online learning in audiology in Syrian universities and in academic fields in general, this study aimed to compare traditional and e-learning methods for postgraduate audiology students.

Objectives

Due to the lack of previous studies about e-learning in Syrian universities, this study was done to compare this method of learning with the traditional learning for post graduate students. this helps to prove its efficacy and the possibility to depend on e-learning as an official way of teaching for students according to its flexibility and affordability to most of the students.

Methods

This study included 60 postgraduate students from the Audiology Department of the Health Sciences Faculty at Damascus University who agreed to take part in this study between 2019 and 2021. Ethical approval was obtained from the Syrian Virtual University (No. 370/0, dated 3/3/2024). These students were divided into two groups. The first group consisted of 31 students (20 females, 11 males) in their first year of the audiology master's program during the 2019/2020 academic year. This group received lectures on "Clinical Aspects of Audiology" in traditional classroom settings at the Health Sciences College of Damascus University through weekly lectures until the COVID-19 lockdown. The second group included 29 students (16 females, 13 males) in their first year of the audiology master's program during the 2020/2021 academic year. Due to the pandemic and the shift to e-learning, this group also studied "Clinical Aspects of Audiology" online.

Synchronous lectures were organized weekly to engage the students in discussions and exchange ideas.

The study utilized an electronic survey on Google Forms (Google LLC, Mountain View, California), comprising two questionnaires. The first questionnaire was administered to the traditional learning group and the other to the e-learning group. Each questionnaire consisted of nine multiple-choice questions focusing on student satisfaction, learning model, teacher interaction, clinical experience, theoretical knowledge acquisition, and obstacles faced during the course. Responses were rated using a Likert scale with four grades: A. very good, B. good, C. acceptable, and D. not satisfactory.

The validity of the questionnaires was assessed by three researchers in the field of medical education (three professors from the Health Sciences College and the Medical Education Master's program of the Syrian Virtual University). They assessed the questionnaires for clarity, style, ease of understanding, and layout. They also reviewed the questionnaires for content validity, including readability, clarity, and comprehensiveness. They all agreed that the questionnaires could be used to attain the desired results after modifying some details, which were followed and corrected as requested (CVI = 1, CVR was between 0.63 and 1 for all items; no item was less than 0.0).

The reliability was assessed using a test-retest reliability measure conducted on two pilot samples from both groups (five students from each group). The pilot samples were asked to repeat the questionnaires the next day, and concordance between the assessments was calculated for each student. Cronbach's alpha coefficient was also used to measure the reliability of the questionnaires; their value was (CA = 0.87), which indicated good and acceptable reliability.

The researcher evaluated the theoretical and clinical exam results of both groups and their clinical assessments during the academic years.

Data analysis was performed using SPSS V27 with a *t*-test to compare mean exam results and clinical assessments. Fisher's exact test was also applied to compare the questionnaires' results between the two groups. Significance was set at a P value < 0.05.

Results

We obtained the results summarized in Table 1 by comparing the results of each compatible question from both questionnaires using Fisher's Exact Test.

The researchers found no statistically significant differences in the results of questions 1, 2, 4, 5, 6, 8, and 9 regarding the students' assessment of the subject, time flexibility of learning, adequacy of the teacher's explanation of the subject's information, the teacher's ability to answer the students' questions adequately, the students' satisfaction with the learning model, use of the subject's information in clinical practice, and the students' satisfaction with the assessment methods (types of exams).

On the other hand, a statistically significant difference was noted when comparing the results of question 3, which asked about the location flexibility of the lectures. The e-learning group felt more flexible attending the lectures online, while the traditional learning group found it a little demanding to attend the lectures in person at the college. In addition, question 7, which asked about the motivation and competition the students felt while studying the subject, showed that the traditional learning group was more motivated and competitive.

To assess the difference in the theoretical knowledge the students gained from the subject, the researcher reviewed the results of the theoretical exams for the two groups. The p-value was 0.460 based on the t-test to compare the mean values of the two groups. Thus, there was no statistically significant difference between the two groups (Table 2).

Table 2. The Results of the Theoretical Exams (Out of 100%)

	Traditional learning	E-learning
Highest value (out of 100%)	96	97
Lowest value (out of 100%)	62	65
Mean	79.65	80.72
Median	80	80
SD	9.196	9.78

SD: Standard deviation

The same was observed when comparing the clinical practice results of the two groups. The t-test showed a p-value of 0.413 > 0.05; no statistically significant difference between the two groups was observed (Table 3).

Table 3. The Results of the Clinical Practice (Out of 100%)

	Traditional learning	E-learning
Highest value (out of 100%)	100	100
Lowest value (out of 100%)	70	68
Mean	83.29	84.06
Median	82	84
SD	9.63	10.25

SD: Standard deviation

Discussion

This research compared traditional and online learning to highlight the importance of e-learning as a

valuable teaching method that can be used widely without affecting the quality of teaching or the learning process. We used electronic surveys to gather the students' viewpoints on the differences between the two teaching methods. Revising the assessment results of the two groups helped determine the effect of the teaching method on the clinical experience and knowledge that the students gained through either method.

The present study did not indicate any significant differences between the traditional learning group and the e-learning group regarding the assessment of the subject or the time flexibility of studying because e-learning is dependent on synchronous lectures, and both groups had to be committed to the exact time of lectures. At the same time, the adequacy of the teacher's explanation of the subject's information, the ability of the teacher to answer the students' questions adequately, the benefits the students received from the two models of teaching, the ability to use the subject's information in clinical practice, and the satisfaction of the students with assessment methods all yielded similar results. This can be attributed to the fact that the same tutors taught the subject to both groups, ensuring that the same amount and quality of information were delivered, regardless of the teaching technique. However, a statistically significant difference was found between the two groups regarding the flexibility of lecture location. The e-learning group felt more flexible, as they could attend the lectures online without the obligation to go to the college and attend in person, unlike the traditional learning group. Students from distant locations did not have to travel or spend money and time on transportation. The researcher also found a statistically significant difference when comparing the two groups regarding motivation and competition factors. Students in the traditional learning group reported feeling more competitive and motivated than students in the e-learning group because being with other students in the same place creates a suitable atmosphere for competition and discussions with tutors and peers. In addition, when students are together in one place, it allows them to prove their knowledge and capabilities, compared to being alone behind the screens.

Similar findings were obtained by Amanda in 2018 (16), who found that students in e-learning feel more comfortable learning in a virtual environment than those in traditional learning. Furthermore, Allaham, in 2023 (17), found that online learning is effective for improving learning and attaining engagement and satisfaction. Al Masri in 2021 (18) reached the same result, stating that most participants in e-learning courses show satisfaction with their knowledge and self-confidence improvement after the e-learning experience. On the other hand, in 2020 (19), Arifani found that motivation factors and social interactions are more apparent and effective among students in traditional learning than among e-learning students. These results correspond firmly with the results of this study.

When talking about the theoretical knowledge and clinical experience that the students of the two groups gained from studying the subject of "Clinical Aspects of Audiology," no statistically significant differences were found between the two groups. Kanjarawi, in 2022 (20), reported that e-learning is an effective and feasible learning method. It helps improve clinical skills and promotes positive attitudes of clinical practitioners toward it. Vallee in 2020 (21) found that e-learning consistently improves knowledge outcomes when compared with traditional learning in health education, while Faulconer in 2018 (22) found that academic results are better for students in e-learning compared to traditional learning. In 2014, through a systematic review, Salter and his colleagues (23) found that e-learning effectively increases knowledge and is a highly acceptable learning method among students. However, there is limited evidence that e-learning effectively improves skills or professional practice, and there is also no evidence that e-learning is effective at increasing knowledge in the long term. Voana and colleagues in 2018 (24) found that compared to traditional learning, e-learning may make little or no difference in patient outcomes or health professionals' behaviors, skills, or knowledge.

The researchers faced some limitations while conducting the study. One of them was the small number of students in the two groups, which could negatively affect the significance of the statistical results. In addition, there was a lack of experience in the academic field with e-learning methods and techniques. The study also faced some obstacles due to technical problems and the limited quality of the internet for both the tutors and the students, which affected the quality of information delivery and effective communication between the students and the tutor.

As this study depended on early trials of e-learning in the Health Sciences College, other studies should be conducted to improve the e-learning technique and learn from the experiences of other universities abroad in this field.

Conclusion

This study helps assess the differences between e-learning and traditional learning at Damascus University. It confirms that e-learning, when applied to audiology master's students, has the same advantages as traditional learning. However, the traditional learning students admitted they had more motivation and enthusiasm than the e-learning students. In contrast, e-learning provided more chronological and demographic comfort than traditional learning. This study also found that e-learning and traditional learning do not differ in the theoretical or practical knowledge they provide to students.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The Ethical approval was taken from the Syrian Virtual University No.370/0, Date 8/2/2021.

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References

1. Lazou C, Tsinakos A. Online versus traditional learning environments: What to inspect, respect, and expect. Athabasca University. [cited 2019 Feb 8]. Available from: URL: https://d1wqtxts1xzle7.cloudfront.net
2. Ferrel MN, Ryan JJ. The Impact of COVID-19 on Medical Education. Cureus. 2020 Mar 31; 12(3): e7492. doi: 10.7759/cureus.7492. [PMID: 32368424] [PMCID: PMC7193226]
3. Sarikhani R, Salari M, Mansouri V. The Impact of E-learning on university students' academic achievement and creativity. Journal of Technical Education and Training. 2016; 8 (1): 25-33.
4. Howlett D, Vincent T, Gainsborough N, Fairclough J, Taylor N, Cohen J, et al. Integration of a Case-Based Online Module into an Undergraduate Curriculum: What is Involved and is it Effective? E-Learning and Digital Media. 2009; 6(4): 372-84. doi: 10.2304/elea.2009.6.4.372.
5. Downes S. E-learning 2.0. E-Learn. 2005; 1(10):1. doi: 10.1145/1104966.1104968.
6. Yang HH. New World, New Learning: Trends and Issues of E-Learning. Procedia- Social and Behavioral Sciences. 2013; 77: 429-42. doi: 10.1016/j.sbspro.2013.03.098.
7. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of E-learning in medical education. Acad Med. 2006 Mar;81(3):207-12. doi: 10.1097/00001888-200603000-00002. [PMID: 16501260]
8. Bernard RM, Abrami PC, Lou Y, Borokhovski E, Wade A, Wozney L, et al. How Does Distance Education Compare with Classroom Instruction? A Meta-Analysis of the Empirical Literature. Review of Educational Research. 2004; 74(3): 379–439. doi: 10.3102/00346543074003379.
9. Ho CL, Dzing R J. Construction safety training via E-learning: Learning effectiveness and user satisfaction. Computers & Education. 2010; 55 (2): 858-67. doi: 10.1016/j.compedu.2010.03.017.
10. Elfaki NK, Abdulraheem I. Impact of e-learning vs traditional learning on student's performance and attitude. International Medical Journal. 2019; 24(03): 225-33.
11. Congdon HB, Nutter DA, Charneski L, Butko P. Impact of hybrid delivery of education on student academic performance and the student experience. Am J Pharm Educ. 2009 Nov 12;73(7):121. doi: 10.5688/aj7307121. [PMID: 19960080] [PMCID: PMC2779633]
12. Almaghaslah D, Ghazwani M, Alsayari A, Khaled A. Pharmacy students' perceptions towards online learning in a Saudi Pharmacy School. Saudi Pharm J. 2018 Jul;26(5):617-621. doi: 10.1016/j.jsps.2018.03.001. [PMID: 29991906] [PMCID: PMC6036186]
13. Baticulon RE, Sy JJ, Alberto NRI, Baron MBC, Mabulay REC, Rizada LGT, et al. Barriers to Online Learning in the Time of COVID-19: A National Survey of Medical Students in the Philippines. Med Sci Educ. 2021 Feb 24;31(2):615-626. doi: 10.1007/s40670-021-01231-z. [PMID: 33649712] [PMCID: PMC7904236]
14. Paul J, Jefferson F. A Comparative Analysis of Students Performance in Online Vs. Face-to-face Environmental Science Course from 2009 to 2016. Frontiers in Computer Science. 2019; 1: 7. doi: 10.3389/fcomp.2019.00007.
15. Badran A, Baydoun E, Hillman S, Mesmar J. Higher education in the Arab world. 1st ed. New York: Springer: 271-94.
16. Hurlbut, Amanda R. Online vs. traditional learning in teacher education: a comparison of student progress. American Journal of Distance Education. 2018;32(4): 248-66. doi: 10.1080/08923647.2018.1509265.
17. Allaham A, Baddour A, Ataya J, Dashash M. The effectiveness of online learning in improving the knowledge about medical coding: a pilot study. Azerbaijan Med J. 2023; 63(3): 8291-9.
18. Regmi K, Jones L. A systematic review of the factors – enablers and barriers – affecting e-learning in health sciences education. BMC Medical Education. 2020;20(1):91.
19. Arifani Y, Suryanti S, Wicaksono BH, Wicaksono BH, Inayati N, Setiawan S. EFL Teacher Blended Professional Training: A Review of Learners' Online and Traditional Learning Interactions Quality. 3L the Southeast Asian Journal of English Language Studies. 2020: 26(3): 124 -38. doi:10.17576/3L-2020-2603-10.
20. Kenjrawi Y, Dashash M. The First Asynchronous Online Evidence-Based Medicine Course for Syrian Health Workforce: Effectiveness and Feasibility Pilot Study. JMIR Form Res. 2022 Oct 25;6(10):e36782. doi: 10.2196/36782. [PMID: 36282556] [PMCID: PMC9644249]
21. Vallée A, Blacher J, Cariou A, Sorbets E. Blended Learning Compared to Traditional Learning in Medical Education: Systematic Review and Meta-Analysis. J Med Internet Res. 2020 Aug 10;22(8):e16504. doi: 10.2196/16504. [PMID: 32773378] [PMCID: PMC7445617]
22. Faulcner EK, Griffith J, Wood B, Acharyya S, Roberts D. A Comparison of Online, Video Synchronous, and Traditional Learning Modes for an Introductory Undergraduate Physics Course. Journal of Science Education and Technology. 2018; 27: 404–11. doi: 10.1007/s10956-018-9732-6.
23. Salter SM, Karia A, Sanfilippo FM, Clifford RM. Effectiveness of E-learning in pharmacy education. Am J Pharm Educ. 2014 May 15;78(4):83. doi: 10.5688/ajpe78483. [PMID: 24850945] [PMCID: PMC4028592]
24. Vaona A, Banzi R, Kwag KH, Rigon G, Cereda D, Pecoraro V, et al. E-learning for health professionals. Cochrane Database Syst Rev. 2018 Jan 21;1(1):CD011736. doi: 10.1002/14651858.CD011736.pub2. [PMID: 29355907] [PMCID: PMC6491176]

Table 1. The Difference between the Two Groups' Answers

Question No.	Traditional learning				E-learning				P value
1	What is your assessment of the course 'Clinical Aspects of Audiology' taught traditionally at the Health Sciences College?				What is your assessment of the 'Clinical Aspects of Audiology' course you took through the e-learning model?				0.36
	A:51.6%	B:29%	C:16.1%	D:3.2%	A:27.9%	B:48.3%	C:13.8%	D:0.0%	
2	Are you satisfied with the timing of the lectures?				Are you satisfied with the time flexibility of the e-learning model?				0.41
	A:35.5%	B:41.9%	C:16.1%	D:6.5%	A:25%	B:41.7%	C:24.1%	D:20.7%	
3	Are you satisfied with the location of the lectures at the Health Sciences College?				Are you satisfied with the location flexibility of the lectures in the e-learning model?				0.016
	A:25.8%	B:45.2%	C:12.9%	D:16.1%	A:65.5%	B:17.2%	C:10.3%	D:6.9%	
4	Are you satisfied with the teacher's explanation of the subject's information?				Are you satisfied with the teacher's role in facilitating the course?				0.805
	A:64.5%	B:19.4%	C:12.9%	D:3.2%	A:58.6%	B:27.6%	C:13.8%	D:0.0%	
5	Are you satisfied with the teacher's ability to answer your questions adequately?				Are you satisfied with the teacher's ability to adequately answer your questions?				0.861
	A:48.4%	B:25.8%	C:22.6%	D:3.2%	A:55.2%	B:27.6%	C:13.8%	D:3.4%	
6	Are you satisfied with the benefits you gained from taking the course in the lecture room and interacting live with the teacher and other students?				Are you satisfied with the multimedia and online resources used to teach the course?				0.117
	A:19.4%	B:54.8%	C:16.1%	D:9.7%	A:48.3%	B:31%	C:13.8%	D:6.9%	
7	Do you feel any sense of motivation or competition?				Do you feel a sense of motivation and competition?				0.012
	A:48.4%	B:29%	C:16.1%	D:6.5%	A:10.3%	B:48.3%	C:24.1%	D:17.2%	
8	Do you feel the information you gained from the course taught traditionally is useful in your clinical practice?				Do you feel the information you gained from the course delivered through the e-learning model is useful in your clinical practice?				0.250
	A:41.9%	B:38.7%	C:19.4%	D:0.0%	A:27.6%	B:37.9%	C:24.1%	D:10.3%	
9	Are you satisfied with the assessment methods?				Are you satisfied with the assessment methods?				0.332
	A:32.3%	B:29%	C:25.8%	D:12.9%	A:20.7%	B:44.8%	C:31%	D:3.4%	

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Policy Brief

Twelve Tips to Improve the Quality of Medical Education, the Experience of AMEE Live 2024 Conference

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Keywords: Medical Education Reform; Competency-Based Education; AMEE 2024; Policy Brief

Dear Editor,

Association for Medical Education in Europe (AMEE), the European regional association of the World Federation for Medical Education and one of the six members of its Executive Council, was founded in Copenhagen in 1972 to facilitate communication and synergy among medical educators in European countries. Each year, AMEE organizes international conferences on various topics in the medical education in a different European country. This year, an international conference was held in Basel, Switzerland. Thanks to the efforts of the Ministry of Health and Medical Education, and in particular, Smart University of Medical Sciences, the online broadcast of this international conference took place from 5 to 8 September 2023, in approximately 15 medical universities across the country, with access to a part of program. In this article, we discussed important educational points based on our experience with this event (1).

AMEE 2024 conference, held in Basel, Switzerland, served as a pivotal event in the field of medical education. The conference, which focused on the professional development of health professionals and the sharing of information among specialists, offered a forum for discussions of the most recent technology and advances in medical education. The conference theme, 'Innovation, Growth and Reimagining Health Professions Education for a Sustainable Future', emphasized the importance of innovation and growth, and the need to reassess and update medical education to meet future challenges and create a sustainable system (2-5). The conference featured a wide range of panels, workshops and keynote speeches that addressed critical issues in the health professions education. Additionally, it offered the chance to exhibit the most recent technologies and accomplishments of esteemed institutions, including hospitals and universities, and to encourage the exchange of ideas and experiences. Other significant aspects highlighted at the conference included the roles of mentorship and student support, learning psychology approaches, using high-level assignments for learners, reliance on team-based assignments, motivating learners, the use of workplace-based assessments, attention to individual learner differences and personalized learning, and using the educational handouts.

Key conference components included:

1. Plenary sessions

- Ronald Harden and Jim Campbell from the World Health Organization (WHO) discussed issues related to health workforce education and achieving the Sustainable Development Goals.

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- Professor Liz Grant from the University of Edinburgh delivered a keynote address on the climate crisis and its effect on health professions education.
- Dr. Jamila Boussari from Maastricht University explored the concept of social justice in health professions education through an Aristotelian lens.

2. Workshops and Masterclasses: A variety of pre-conference workshops and masterclasses focused on topics, such as educational technology, professional skills development, and using artificial intelligence in education.

3. Networking and Mentoring Sessions: The conference provided ample opportunity for networking and mentoring sessions.

4. Research and presentations: The conference featured research papers, doctoral reports, and electronic posters that facilitated academic discussion and knowledge exchange in the field of health professions education.

Key Highlights and Takeaways from the AMEE 2024 Conference:

1. Focus on Innovative Educational Technologies: The conference highlighted using virtual simulations and interactive learning tools as modern teaching methods that significantly improve medical education.

2. Importance of International Learning: Emphasis was placed on international collaborations, and knowledge exchange among different educational institutions to elevate global educational standards.

3. Developing Medical Education to Meet Future Needs: Educational programs are being designed to prepare medical students and professionals for future challenges.

4. Interdisciplinary Approach to Education: The importance of interdisciplinary education and collaboration among different medical and scientific disciplines was emphasized to achieve more comprehensive approaches to treatment and medical care.

5. Curriculum Transformation and Review: There were extensive discussions on reforming and updating curricula to meet current and future needs. The importance of reviewing medical curricula, and using common models for needs assessment and curriculum review was highlighted by the experts. Competency-based education, which emphasizes the skills and abilities that learners should possess upon completion of the educational program, was introduced as a novel and effective method of medical education.

6. Emphasis on Ethics and Social Responsibility: Ethical education and attention to social responsibility among medical professionals were significant topics at the conference.

7. Use of Data and Artificial Intelligence in Education: The applications of data mining and artificial intelligence to improve teaching methods, clinical reasoning, and designing curricula to prepare students for a future with generative Artificial Intelligence were discussed.

8. Focus on Lifelong Learning: Programs, such as online courses, workshops, seminars, and the formation of specialized associations were suggested to encourage lifelong learning among medical professionals to keep them up-to-date.

9. Role of Blended Learning: The combination of face-to-face and online education was presented as an effective method to expand access to medical education.

10. Innovation in Student Assessment: New assessment methods that measure not only knowledge but also students' skills and attitudes were introduced. Workplace-based evaluations were also emphasized as critical tools for assessing the performance of students and trainees in real-world clinical settings. One prominent example of these assessments was multi-source feedback from colleagues and supervisors, which helps improve students' clinical and professional skills continuously. This approach is particularly vital for ensuring the practical and professional readiness of medical students in real-world clinical settings.

11. Networking: Networking was identified as a key factor in professional development in the medical education. One of the main focuses of the conference was to facilitate international connections and collaborations, which can improve the quality of education and research in medicine. Networking was identified as a means of promoting information sharing, inspiration, and innovation in medical education, particularly in areas requiring multidisciplinary methods and worldwide cooperation. The conference also emphasized the creation of social networks to empower and grow faculty members.

12. Connection between Climate Change and Global Health in Medical Education: A key focus of the conference was the examination of climate change's effects on global health and its significance in medical

education. This highlighted the importance of educating physicians and other health professionals about the challenges associated with climate change. Professor Liz Grant from the University of Edinburgh emphasized that the effects of climate change directly impact global health, and require urgent and coordinated international action. Education in this area can better prepare physicians to face these crises and reduce their negative impacts on health.

Conclusion

Implementing these strategies can help Iranian medical schools raise educational standards and meet the evolving demands of contemporary healthcare.

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References

1. International Association for Health Professions Education (AMEE); [cited 2024 Sep 22]. Available from: https://amee.org/amee-2024/
2. Abdel Malak, Marina. Quality Improvement in Medical Education: Implications for Curriculum Change. Acad Med. 2017 Apr;92(4):431-2. doi: 10.1097/ACM.0000000000001600. [PMID: 28350603]
3. Ramezani G, Zarezadeh Y, Sohrabi Z. Elaboration of indices of the Third Generation of the universities of medical sciences: Status quo assessment of Iran University of Medical Sciences. J Educ Health Promot. 2021 Jul 30:10:255. doi: 10.4103/jehp.jehp_1462_20. [PMID: 34485552] [PMCID: PMC8395950]
4. Niromand E, Mansoory MS, Ramezani G, Khazaei MR. Design, implementation and evaluation of e-learning program for common diseases to smartphone-based medical students: at a developing university. BMC Med Educ. 2024 Jan 10; 24(1): 52. doi: 10.1186/s12909-023-05023-4. [PMID: 38200462] [PMCID: PMC10782709]
5. Rasouli D, Norouzi A, Ramezani G, Hashemi A. A psychometric evaluation of inter-professional education competency tool in nursing and medicine students. BMC Med Educ. 2024 Feb 1;24(1):110. doi: 10.1186/s12909-023-04991-x. [PMID: 38302962] [PMCID: PMC10835904]

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Original Article

Academic Bullying: A Concept Analysis via Walker and Avant's Method

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Abstract

Background: Academic bullying is a global and growing phenomenon in educational settings. Yet, there is a lack of consensus concerning the definitions of academic bullying which challenges researchers. The purpose of this analysis, therefore, was to conceptualize the concept of academic bullying, including its definitions, defining characteristics, antecedents, consequences, and empirical referents.

Objectives: The purpose of this analysis, therefore, was to conceptualize the concept of academic bullying, including its definitions, defining characteristics, antecedents, consequences, and empirical referents.

Methods: Walker and Avant's method of concept analysis was employed to identify the antecedents, attributes, and consequences of academic bullying. A review of existing literature on academic bullying was conducted using the electronic databases of PubMed, Scopus, Web of Science, Science Direct, and ProQuest, searched with the phrase of "academic bullying" in the titles of documents without a time limit. The search included all document types (article, review, editorial, letter, note, book, book chapter and dissertation) related to academic bullying published in English.

Results: In reviewing the studies, 37 documents were identified to provide information for this concept analysis. Based on the analysis undertaken, a working definition and defining attributes were formulated, along with a discussion of various model cases, antecedents, consequences, and empirical referents regarding academic bullying.

Conclusion: Educational leaders can prevent or reduce faculty bullying by raising awareness, offering training, and establishing guidelines. The identification of academic bullying attributes contributes to the body of knowledge of academic bullying, reduces the ambiguity of this concept, and provides a working definition of academic bullying. Defining attributes, antecedents, and consequences can be further tested and used to develop potential interventions. Future research is needed to advance our understanding of this concept and explore interventions that could diminish its negative consequences.

Keywords: Concept Analysis; Academic Bullying; Walker and Avant; Academia

Background

Universities worldwide are recognized as scientific and intellectual establishments, with their leaders typically fostering a democratic environment and encouraging interactive relationships among faculty, staff, and students through dialogue and persuasion rather than coercion and obligation. Upon observing university culture, it becomes evident that faculty members are the central pillar of these institutions (1), to the extent that some specialists view them as the embodiment of scientific and academic values (2). Academia can offer a wonderful career path, but the power differentials at play in the university life can turn promising careers into nightmares (3). Analyzing precise terminology and common definitions is crucial for establishing the boundaries of workplace bullying and determining what will be perceived as such within an organization (4). Academic bullying is a global and growing phenomenon in educational settings. Yet, there is a lack of consensus regarding the definitions of academic bullying which challenges researchers.

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In organizations such as universities, where task-oriented expertise, autonomy, and individualism are emphasized, the specific nature of bullying is difficult to define (5). There is no universally accepted definition of bullying (6). Ferguson et al. argued that researchers have yet to reach a consensus on a clear definition of bullying, which complicates bullying research, particularly in measuring its prevalence (6). Compared to workplace bullying in other industries, academic bullying has received less attention (7). Academic bullying among faculty is a prevalent form of workplace bullying, though it has received less research attention than other types (8). A universal definition of bullying remains elusive despite researchers' efforts. Gaining international attention in the 20th century, bullying has since been recognized as a global phenomenon, prompting worldwide research (9, 10). Despite significant attention to academic bullying, a clear and satisfactory definition remains elusive. A precise understanding of academic bullying can illuminate its causative factors.

This article defines academic bullying by exploring its definitions, applications, antecedents, attributes, and consequences. Such clarity enhances understanding for caregivers and researchers. Accordingly, this study aims to investigate the nature of academic bullying and the factors influencing its occurrence. While bullying occurs across all professions, its nuances among faculty have not been thoroughly examined. A detailed analysis of these characteristics can mitigate its impact on faculty and enhance understanding for effective intervention. This study aims to analyze the concept of bullying in depth using Walker and Avant's methodology.

Concept selection and aims of the analysis

Concepts serve as the foundational elements of theories, and concept analysis seeks to deconstruct a term to: (a) evaluate its components, (b) clarify vague aspects of a theory, (c) enhance understanding of the concept, and (d) ultimately establish a consistent definition to aid in its measurement (11). Although academic bullying is a global and growing phenomenon in educational settings, there is a lack of consensus with regards to the definitions of academic bullying which challenges researchers. In view of this, we undertook the current analysis to provide clarity regarding the meaning of the concept of academic bullying while gaining a more comprehensive understanding of its attributes, antecedents, and consequences. Therefore, in this study we aimed at analyzing the concept of academic bullying among faculty members.

The following research questions were addressed:

1. How is academic bullying defined in existing literature?
2. What attributes can help identify academic bullying?
3. What are the antecedents and consequences of academic bullying?
4. What working definition of academic bullying can be derived from the current evidence?

Objectives

The purpose of this analysis, therefore, was to conceptualize the concept of academic bullying, including its definitions, defining characteristics, antecedents, consequences, and empirical referents.

Methods

Concept analysis method: To accurately define "bullying among faculty members," concept development methods should be employed. Concept analysis serves as a systematic approach to clarify the concept, reduce ambiguities, ensure semantic integration, and enhance its stability in relevant discussions and literature (11). The aim of concept analysis can be either clarification or the establishment of an operational definition (12). This process is a meticulous endeavor that requires a serious approach to uncover the underlying semantic elements of the concept (13). In line with our research questions, this study used Walker and Avant's (14) concept analysis method to describe and clarify the concept of academic bullying from May to June 2024.

A concept analysis is a methodology that examines a concept's function and presents its defining attributes to foster a consistent understanding of a phenomenon (11). Walker and Avant's concept analysis method includes eight steps (11) (Table 1). Walker and Avant's method helped identify all related applications of the academic bullying concept as well as determine the defining attributes, antecedents, and consequences.

Table 1. Walker and Avant's eight-step method

Steps
1. Select a concept
2. Determine the aim of analysis
3. Identify all uses of the concept
4. Determine the defining attributes
5. Construct a model case
6. Construct borderline and contrary cases
7. Identify antecedents and consequences
8. Define empirical referents

Literature search strategy: Walker and Avant recommend full utilization of all data sources to compile

a comprehensive inventory of relevant characteristics and variables (11). A systematic search was conducted in five key online databases, including PubMed, Scopus, Web of Science, Science Direct, and ProQuest without time limitation, using the following combined keyword: "academic bullying". The online databases were searched for titles containing this term. No date limitation was applied in the search strategy.

Inclusion and exclusion criteria: Our primary goal was to identify key sources discussing academic bullying and examine its various aspects. The search was limited to documents containing the definition of academic bullying and written in English. Inclusion criteria included all document types (article, review, editorial, letter, note, book, book chapter and dissertation), written in English, and those that had discussed the attributes, antecedents, and consequences of academic bullying concept without publication limit. Only literature that had addressed "academic bullying" in the title was included. Duplicate studies and those that had not mentioned the definition of academic bullying were excluded from the final review.

Selection process: Initially, 89 document types (article, review, editorial, letter, note, book, book chapter and dissertation) were identified. Table 2 reports the search results for each database and number of findings by document type before duplication removing. After removing duplicates, the document titles were reviewed, leading to a total of 38 documents. These documents were then fully assessed against the inclusion criteria, resulting in the exclusion of 1 document. As such, 37 documents met the inclusion criteria and were included in the concept analysis; see Figure 1 for a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of the process (15). Using inclusion criteria, 19 articles, 5 letters, 3 editorials, 3 book chapters, 1 book, 1 note, 2 reviews and 3 dissertations were identified (Table 3). We used different document types with respect to academic bullying to find more relevant results. Traditionally, the Merriam-Webster Medical Dictionary was also used to define the concept of academic bullying.

Results

The concept analysis results are presented using the Walker and Avant method (11).

1. Definitions and uses of concept

The first two steps of the Walker and Avant analysis method are outlined in the Introduction. The third step involves identifying various usages of the concept (11), accomplished through the use of dictionaries and literature.

There is no dictionary definition noted for the compound phrase "academic bullying"; therefore we started with the definitions of the words academic and bullying. The Merriam Webster dictionary defines academic as a "member (such as a professor) of an institution of learning (such as a university)" (16).

The term academic specifically refers to individuals connected with the academic institution (17). Bullying is defined as using strength or power to intimidate or harm those who are weaker (16). Bullying is intentional and aimed at a specific target to cause harm (18). Bullying is a repeated and intentional act of aggression directed at individuals viewed as less powerful (19). Bullying behaviors may involve hostile remarks, verbal attacks, threats, taunts, intimidation, belittling, eye-rolling, loud sighing, name-calling, and exclusion or refusal to offer support (20, 21). There are few definitions of academic bullying found in the literature. Therefore, incorporating the term "academic" with "bullying" clarifies the concept by specifying the environment and the individuals engaging in the behavior.

Academic bullying refers to the persistent harassment, offense, or intentional isolation of an individual within an academic environment. It encompasses a range of inappropriate behaviors, including credit abuse, violations of rules and ethical guidelines, coercive control, mental harassment, cyberbullying, mobbing, retaliation, threats, and verbal abuse (22, 23). Mahmoud et al. defined academic bullying as abusive behavior, including verbal insults, public shaming, isolation, and threats, directed by senior scientists toward vulnerable junior colleagues such as postdocs, graduate students, and lab members (24).

Table 3. Number of findings by document type after duplication removal

Document type	Frequency
Article	19
Letter	5
Review	2
Editorial	3
Note	1
Book	1
Book chapter	3
Dissertation	3
Total	37

Academic bullying refers to ongoing hostility and mistreatment from an academic superior (25). Indeed,

academic bullying refers to mistreatment in academic settings aimed at hindering the victim's academic or career advancement (26). It is also a violation of human rights within an academic setting (27).

2. Defining attributes

Walker and Avant proposed that identifying the defining cluster of attributes most commonly associated with the concept is a vital aspect of analysis. These attributes help in distinguishing the concept from other similar concepts (11). Upon reviewing the literature for this concept analysis, four key attributes consistently emerged in the depiction of academic bullying:

1. Competition: One of the considered attributes is the competitive nature of academia. The competitive environment in academia also drives bullying. Scientists and clinical researchers strive for prominence to enhance their academic standing and secure funding. Metrics such as the h-index gauge the overall impact and significance of research efforts. Nonetheless, these indicators can be deceptive, linking output quantity to success and potentially steering researchers towards producing a greater number of superficial studies instead of focusing on producing high-quality and impactful work (24). Additionally, within the academic realm, a culture of competition could foster negative behaviors assuming undue authorship rights or theft of intellectual property (28).

2. Superiority: Academic bullying refers to a continuous and escalating demonstration of hostile conduct and abuse by a superior in academia (28).

3. Power: It is well-documented that academic bullying, primarily fueled by power imbalances, impacts individuals in all fields and academic roles, from students to senior faculty, at various experience levels (the need for the development). It commonly originates from the misuse of power by individuals with social and positional privileges (29).

4. Behavior: Academic bullying occurs when senior scientists verbally insult, publicly shame, isolate, or threaten junior colleagues, including postdocs, graduate students, and lab members (24).

3. Model Case

A model case exemplifies the use of a concept by demonstrating all its defining attributes. These cases can be real-life examples, found in literature, or even constructed by the researcher (11). The constructed case model illustrating all attributes of academic bullying is presented here:

A.K, a 45-year-old faculty member at the school of medicine, is an assistant professor who was recently hired. Despite her colleagues being full professors with over 12 years of experience, they frequently belittle her opinions during their monthly meetings. They often assign her their tasks and even coerce her into including their names in her research articles. A.K was ordered by her colleagues to increase her workload. They openly question her experience and knowledge in front of other faculty members, often ridiculing her. When it comes to granting allocation from the research committee, they engage in unfair competition to secure more funding, sometimes overlooking A.K. During course and educational material discussions at the start of the term, A.K is consistently excluded as her colleagues deem her inexperienced and lacking in knowledge. They assert their superiority in ranking and scientific expertise, humiliating A.K along the process. Despite the passage of time, A.K's working environment remains unchanged, devoid of friendly relationships within her department. Her colleagues have recently begun to complain about her work performance.

This model case included all four key attributes of academic bullying: competition, behavior, power, and a sense of superiority. A.K endured academic bullying from her colleagues, leading to stress, anxiety, depression, diminished confidence and self-esteem, and contemplating leaving her role as a faculty member.

4. Related case

Related cases are examples that pertain to the studied concept but lack all its defining attributes (11). Below is an example of a related case of academic bullying.

L.A is a tenured faculty member at the school of medicine. He rarely participates in group meetings and disrespects colleagues by doing so. When a national or international conference is to be held in the school, he does not participate in coordination meetings, but as soon as the conference commences, he appears and pretends to be one of the active members. This behavior frustrates and bothers B.A, his fellow faculty member.

In this example, the behaviors displayed are impolite. L.A's actions do not seem to be aimed at causing harm on purpose, and they are not as extreme as typical bullying behaviors. It is also unclear whether there is abuse of power in this related case.

5. Borderline case

Borderline cases are instances that encompass most, but not all, defining attributes of the examined concept (11).

R.A is a faculty member at the school of medicine, holding a full professor rank with a decade of experience. He currently heads the department of general medicine

and has a tenured status. Z.A, who has two years of experience but does not have tenure status, focuses on an artificial intelligence project to enhance education. However, R.A, the head of department, showed no interest and declined approval. Z.A went to R.A's office, suggesting a group discussion on the project, but R.A dismissed the idea, citing the proficiency of the two full professors within the group and deeming Z.A's project unnecessary given her junior rank.

Two attributes of academic bullying (sense of superiority and abuse of power) are highlighted in this borderline case. It illustrates abuse of power by a faculty member refusing a request of his colleague and the display of superiority by attempting to belittle someone of a lower rank or status. Other defining attributes (behavior and competition) were not observed here in this case, making this example a borderline case.

6. Contrary case

A contrary case lacks the key characteristics of the concept and instead displays attributes that are atypical of it (11). The case below represents a contrary case:

T.B, a new faculty member in the medical education department, was warmly welcomed by the four tenured associate professors in the group despite his non-tenured status, treating him as a valued colleague in their research projects. During monthly meetings, his colleagues attentively listen to him, respecting his constructive comments to promote the group's objectives. His teaching style is admired by the professors, who provide guidance and support as needed. T.B appreciates the kindness and encouragement from his colleagues, which motivates him to attend work with enthusiasm and dedication daily. Further, these positive interactions contribute to his best performance.

The case is an example of the contrary concept as it lacks any defining attributes of academic bullying.

7. Antecedents and Consequences

Antecedents: Walker & Avant define antecedents as events or incidents that must happen before a concept can occur (11). Accordingly, in the associated literature on academic bullying, common antecedents linked to academic bullying are academic culture and environment, unethical leaders, biased investigations, unaccountability, abusive behaviors , negative work-related remarks, work overload, unfair crediting, lack of transparency and legal approach, feelings of superiority, unreasonable work-related demands, gender, imbalance of power, illiteracy, academic experience, competitive nature of academia, institution punishments, online space, marginalization, substantial financial burdens, and COVID-19 pandemic (1, 3, 24, 28-43).

Consequences: Consequences are considered the outcome of the antecedents and the defining attributes (11). Some of the consequences of academic bullying include slowing the evolution of science, harming self-esteem, promotion and professional credentials, as well as validity of academia, physical and mental well-being, reducing academic workforce, organizational commitment, confidence, sense of freedom, effective mentorship and advice, and motivation, hindering the progress of star scientists and scientific integrity, enhancing the file drawer problem, undue authorship rights, negative job attitudes, dissatisfaction, anxiety, stress, burnout, depression, workplace retaliation, toxic work environment, negative effect on education, theft of intellectual property, withdraw from situations, economic and social inequities, isolation, poorer performance, inducing feelings of fear, anguish, suicidal thinking, frustration, powerlessness and inferiority, and finally threatening one's professional trajectory (1, 3, 28-32, 34, 35, 44).

8. Empirical referents

Walker and Avant define empirical referents as the ultimate outcomes of a concept, serving as tools to identify or evaluate its defining characteristics or attributes (11).

Despite some studies on academic bullying, a review of the literature by the authors reveals no universally accepted measurement tool for academic bullying. The Negative Acts Questionnaire-Revised (NAQ-R), created by Einarsen, Hoel, and Notelaers, is frequently used to assess bullying, specifically among teachers over the past six months. This 22-item questionnaire employs a five-point Likert scale ranging from "never" to "daily." It assesses three dimensions: personal bullying (items 2, 4, 5, 6, 7, 10, 11, 12, 13, 15, 17, and 20), work-related bullying (items 1, 3, 14, 16, 18, 19, and 21), and physically intimidating bullying (items 8, 9, and 22) (45). A study by Einarsen, Hoel, and Notelaers validated the NAQ-R as an effective measure of workplace bullying exposure. The Pearson product-moment correlation was high (r = .96). The average score for the three NAQ-R sub-factors, including work-related bullying, was 14.51, with a standard deviation of 5.04. The correlation for the validity of self-labeling questions was also strong (r = 0.54). Additionally, the NAQ-R's 22 items demonstrated excellent internal consistency, with a Cronbach's alpha of .90 (45).

To gain a more profound insight into academic bullying, use of qualitative research might be a fitting approach to capture faculty members' encounters with this behavior. Further, faculty members' narratives could help describe the experience, perspectives, and significance of this phenomenon.

9. Working Definition

Expanding on the current definitions and evidence relating to academic bullying, the following description would serve as the working and operational definition for this concept analysis. This working definition can assist in identifying academic bullying within an academic setting:

Academic bullying is defined as an atypical behavior that arises from the misuse of power, work experience, academic ranking, tenured status, political relationships, and unsafe academic competition against colleagues in the academic setting, potentially resulting in emotional, psychological, social, and sometimes physical problems. In a nutshell, it is a battle of power and fame in academic settings for the wrong reasons.

Discussion

Academic bullying is a phenomenon that requires more attention and consideration due to its negative impact on faculty members, academic structure, and students. Recognizing academic bullying in educational environments raises awareness of its presence and can empower the faculty to stand against this issue. This concept analysis utilized Walker and Avant's method to identify defining attributes, antecedents, consequences, and empirical references of academic bullying, offering a clearer understanding of the term. Based on our findings, we propose a working definition of academic bullying (11). Academic intimidation among faculty members is a widespread problem in higher education institutions, with different types recognized including purposeful isolation, hindrance of career progression, and settling personal scores (46). Moreover, at an academic organizational level, bullying cultures foster a toxic work environment, which may negatively affect recruitment, scientific integrity, educational quality and knowledge dissemination and the reputation of the academic research sphere (36). Academic bullying is prevalent in fields such as science and medicine. This detrimental behavior undermines individuals' dignity and professional integrity. To effectively address and eradicate these harmful incidents, systematic study and comprehensive reform are essential (28).

In addressing academic bullying's negative impacts and the elements of escalation in academic bullying, a multi-faceted and multi-agency approach should be taken for addressing academic bullying. This involves proposing institutional and policy recommendations to ensure universities adhere to human rights standards and adequately safeguard academics from attacks (32, 44). Bullying, a severe form of mistreatment, occurs when someone in a position of authority intentionally subjects a target to persistent negative behaviors. In academic medicine, such bullying aims to hinder the target's professional development. While there is ample literature on addressing various forms of mistreatment, research specifically on bullying among academic medical faculty members remains limited (47). Academic administrators and authorities should instruct faculty members on methods to avert and lessen academic bullying. They should also assist individuals facing academic bullying through guiding responding to and reporting such incidents. Establishing collaborative and coordinated action among all stakeholders interested in and capable of influencing academic bullying is uniquely positioned to effectively tackle the underlying causes of this escalating problem, thereby enabling everyone to excel and progress (36). In addition to the structural elements of academia, the culture within an academic department significantly impacts bullying rates. Recognizing the broader systemic factors that influence departmental dynamics allows for thoughtful responses to bullying. Ultimately, this understanding provides guidance on how to cultivate a more inclusive and engaged departmental culture, thereby reducing instances of bullying (48). Academia can provide a rewarding career path, but the power dynamics inherent in university settings can sometimes turn promising careers into nightmares. Academic bullying is a long-standing, serious issue that affects individuals in various positions across all branches of science (3). Academic bullying and harassment severely impact both individuals and institutions, often going unreported. Perpetrators and bystanders ignore misconduct due to psychological factors influenced by their hierarchical positions. Institutions must counteract this deliberate ignorance by researching the prevalence, causes, and consequences of such behavior. This knowledge can help develop effective, evidence-based interventions, enabling institutions to manage and prevent misconduct more effectively (49).

Both qualitative and quantitative research are essential for comprehending academic bullying and its effects on teaching, learning, research processes, as well as faculty members' practice quality and safety. Usage of a mixed method study can enhance the development of the academic bullying concept, resulting in a more well-defined and relevant working definition for future studies and investigate the extent to which antecedents contribute to its incidents in academic setting.

Limitations: This concept analysis provided a comprehensive review of the literature, but two limitations were found. Firstly, all reviewed documents were only in English. Therefore, further research is needed to explore literature on academic bullying in other languages. Secondly, the concept analysis only included a literature review from select research databases such as PubMed, Scopus, and the Web of Science, Science Direct, and ProQuest. Thus, a more comprehensive analysis should involve reviewing research from other educational databases as well.

Conclusion

This study demonstrated that the concept of academic bullying is a developing phenomenon in academic setting in recent years, though there is no clear and precise definition of this concept. Applying Walker and Avant's (11) method, we found that academic bullying is a concept that emerged as negative interpersonal interactions among individuals or groups that have educational roles within an academic setting where power imbalances often lead to intentional harm toward others. As the work environment continues in dictatorial and hostile manner, the concept of academic bullying becomes critical. Academic bullying is a developing phenomenon in academic settings, indicating that faculty members should recognize it when it occurs among their colleagues. Using Walker and Avant's concept analysis method (11), this study provides readers with comprehensive information on the attributes, antecedents, consequences, and empirical referents of academic bullying. Therefore, this concept analysis paves the way for further research to make academic bullying concept more understandable as well as advise strategies and interventions to diminish its occurrences and adverse impacts. A working definition was created to offer opportunities specifically for faculty members to be aware of academic bullying in academic settings and distinguish its possible antecedents plus consequences and take legal steps to mitigate it in work environment.

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References

1. Hassan AATS. A Causal Model of the Mutual Relationships Between Academic Bullying, Suicidal Thinking, and Psychological Immunity Among University Students. Turkish Journal of Computer and Mathematics Education (TURCOMAT). 2021;12(3):4298-309. doi: 10.17762/turcomat.v12i3.1721.
2. Flaherty C. Study says students rate men more highly than women even when they're teaching identical courses. March. 2018;14.
3. Mahmoudi M. Academic bullying slows the evolution of science. Nature Reviews Materials. 2023;8(5):301-3. doi: 10.1038/s41578-023-00549-x.
4. Liefooghe AP, Mac Davey K. Accounts of workplace bullying: The role of the organization. European Journal of work and organizational psychology. 2001;10(4):375-92. doi: 10.1080/13594320143000762.
5. Agervold M. Bullying at work: A discussion of definitions and prevalence, based on an empirical study. Scand J Psychol. 2007 Apr;48(2):161-72. doi: 10.1111/j.1467-9450.2007.00585.x. [PMID: 17430369]
6. Ferguson CJ, Miguel CS, Kilburn Jr JC, Sanchez P. The effectiveness of school-based anti-bullying programs: A meta-analytic review. Criminal Justice Review. 2007;32(4):401-14. doi: 10.1177/0734016807311712.
7. Ilievski F, Mirica KA, Ellerbee AK, Whitesides GM. Templated self-assembly in three dimensions using magnetic levitation. Soft Matter. 2011;7(19):9113-8. doi: 10.1039/c1sm05962a.
8. Mahmoudi M. Academic bullies leave no trace. Bioimpacts. 2019;9(3):129-130. doi: 10.15171/bi.2019.17. [PMID: 31508328] [PMCID: PMC6726746]
9. Ross SW, Horner RH, Higbee T. Bully prevention in positive behavior support. J Appl Behav Anal. 2009 Winter;42(4): 747-59. doi: 10.1901/jaba.2009.42-747. [PMID: 20514181] [PMCID: PMC2791686]
10. Williford A, Elledge LC, Boulton AJ, DePaolis KJ, Little TD, Salmivalli C. Effects of the KiVa antibullying program on cyberbullying and cybervictimization frequency among Finnish youth. J Clin Child Adolesc Psychol. 2013;42(6):820-33. doi: 10.1080/15374416.2013.787623. [PMID: 23659182]
11. Walker LO, Avant KC. Strategies for Theory Construction in Nursing. New Jersey: Pearson/Prentice Hall; 2019.

12. Rafii F, Parvizy S, Mehrdad N, Peyrovi H, Khoddam H. Clarification of knowledge translation in health system. Iran J Nurs Reaserch. 2012;7(24):72–81. [In Persian]
13. Chinn PL. Theory and nursing: a systematic approach. St Louis: Mosby; 1983.
14. Muneer A MB, Krishnamoorthy S, Zumla A. Urogenital tuberculosis—epidemiology, pathogenesis and clinical features. Nat Rev Urol. 2019 Oct;16(10):573-598. doi: 10.1038/s41585-019-0228-9. [PMID: 31548730]
15. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group* t. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009 Jul 21;6(7):e1000097. doi: 10.1371/journal.pmed.1000097. [PMID: 19621072] [PMCID: PMC2707599]
16. Merriam-Webster I. Merriam-Webster's collegiate thesaurus: Merriam Webster; 1993.
17. Fry A, Schmer C. Nursing faculty bullying: concept analysis. J Prof Nurs. 2021 Nov-Dec; 37(6): 1197-202. doi: 10.1016/j.profnurs.2021.11.001. [PMID: 34887041]
18. Lachman VD. Ethical issues in the disruptive behaviors of incivility, bullying, and horizontal/lateral violence. Medsurg Nurs. 2014;23(1):56-8. [PMID: 24707670]
19. Olweus D. Bullying at school: basic facts and effects of a school based intervention program. J Child Psychol Psychiatry. 1994 Oct;35(7):1171-90. doi: 10.1111/j.1469-7610.1994.tb01229.x. [PMID: 7806605]
20. Gallo VJ. Incivility in nursing education: A review of the literature. Teaching and learning in Nursing. 2012;7(2):62-6. doi: 10.1016/j.teln.2011.11.006.
21. McNamara SA. Incivility in nursing: Unsafe nurse, unsafe patients. AORN J. 2012 Apr;95(4):535-40. doi: 10.1016/j.aorn.2012.01.020. [PMID: 22464626]
22. Moss S. Research is set up for bullies to thrive. Nature. 2018 Aug;560(7720):529. doi: 10.1038/d41586-018-06040-w. [PMID: 30154542]
23. Tepper BJ, Moss SE, Lockhart DE, Carr JC. Abusive supervision, upward maintenance communication, and subordinates' psychological distress. Academy of management Journal. 2007;50(5):1169-80. doi: 10.5465/amj.2007.20159918.
24. Mahmoudi M, Ameli S, Moss S. The urgent need for modification of scientific ranking indexes to facilitate scientific progress and diminish academic bullying. Bioimpacts. 2020;10(1):5-7. doi: 10.15171/bi.2019.30. [PMID: 31988851] [PMCID: PMC6977587]
25. Moss SE, Mahmoudi M. STEM the bullying: An empirical investigation of abusive supervision in academic science. EClinicalMedicine. 2021 Sep 8:40:101121. doi: 10.1016/j.eclinm.2021.101121. [PMID: 34527894] [PMCID: PMC8433114]
26. McCarthy P. Bullying at work: A postmodern experience. Bullying and emotional abuse in the workplace. 1st Ed. Florida, US: CRC Press; 2003: 249-62. doi: 10.1201/9780203164662-19.
27. Täuber S, Oliveri NF, Kostakopoulou D, Mahmoudi M. Breaking the silence around academic harassment. FEBS Lett. 2022 Sep;596(18):2337-2344. doi: 10.1002/1873-3468.14473. [PMID: 36052874]
28. Manuel P, Tang GH, Weyand A, James P, Sholzberg M. Academic bullying in science and medicine: the need for reform. Res Pract Thromb Haemost. 2023 Nov 20;8(1):102270. doi: 10.1016/j.rpth.2023.102270. [PMID: 38222079] [PMCID: PMC10784303]
29. Parrish III WP. "I Love the Work, but I Hate My Job": A Critical Narrative Inquiry on Academic Bullying Among Faculty at Four-Year Institutions. Madison, WI, USA: The University of Wisconsin-Madison; 2023.
30. Averbuch T, Eliya Y, Van Spall HGC. Systematic review of academic bullying in medical settings: dynamics and consequences. BMJ Open. 2021 Jul 12;11(7):e043256. doi: 10.1136/bmjopen-2020-043256. [PMID: 34253657] [PMCID: PMC8311313]
31. Baker SJ. (dissertation) Creating a Portrait of the Academic Mean Girl: A Qualitative, Feminist Approach Identifying the Ascension of Women to the Deanship in An Academic Bullying Culture. New Mexico: New Mexico State University; 2019.
32. Kostakopoulou D, Mahmoudi M. Academic Bullying and Human Rights: Is It Time to Take Them Seriously? Human Rights Review. 2024; 25(1): 25-46. doi: 10.1007/s12142-024-00713-y.
33. Mahmoudi M. A survivor's guide to academic bullying. Nat Hum Behav. 2020 Nov;4(11):1091. doi: 10.1038/s41562-020-00937-1. [PMID: 32868883]
34. Mahmoudi M. A brief guide to academic bullying. 1st Ed. New York: Jenny Stanford Pub; 2021. doi: 10.1201/9781003160342.
35. Mahmoudi M, Keashly L. COVID-19 pandemic may fuel academic bullying. Bioimpacts. 2020;10(3):139-140. doi: 10.34172/bi.2020.17. [PMID: 32793435] [PMCID: PMC7416009]
36. Mahmoudi M, Keashly L. Filling the space: a framework for coordinated global actions to diminish academic bullying. Angew Chem Int Ed Engl. 2021 Feb 15; 60(7): 3338-44. doi: 10.1002/anie.202009270. [PMID: 33295129]
37. Mahmoudi M, Moss S. The absence of legal remedies following academic bullying. Bioimpacts. 2020;10(2):63-64. doi: 10.34172/bi.2020.08. [PMID: 32363149] [PMCID: PMC7186547]
38. Mahmoudi M, Moss S, Keashly L. On the issue of transparency on the internal investigation of academic bullying. Bioimpacts. 2022;12(1):1-2. doi: 10.34172/bi.2021.44. [PMID: 35087710] [PMCID: PMC8783085]
39. Martinez RCK, Cabale WJ. Understanding Academic Bullying in an Online Environment as Uncaring Encounter. Journal of Health and Caring Sciences. 2021;3(1):18-32. doi: 10.37719/jhcs.2021.v3i1.oa002.
40. Meriläinen M, Käyhkö K, Kõiv K, Sinkkonen HM. Academic bullying among faculty personnel in Estonia and Finland. Journal of Higher Education Policy and Management. 2019;41(3):241-61. doi: 10.1080/1360080X.2019.1591678.
41. Moss S, Täuber S, Sharifi S, Mahmoudi M. The need for the development of discipline-specific approaches to address academic bullying. EClinicalMedicine. 2022 Aug 3:50:101598. doi: 10.1016/j.eclinm.2022.101598. [PMID: 36035438] [PMCID: PMC9403844]
42. Noakes T, Noakes T. Distinguishing online academic bullying: identifying new forms of harassment in a dissenting Emeritus Professor's case. Heliyon. 2021 Feb 24;7(2):e06326. doi: 10.1016/j.heliyon.2021.e06326. [PMID: 33718643] [PMCID: PMC7921510]
43. Swann JM. Academic bullying and diversity: challenges and solutions. FEBS Lett. 2022 Nov;596(22):2855-2858. doi: 10.1002/1873-3468.14504. [PMID: 36196932]
44. Krishna A, Soumyaja D. Exploring the Escalation Process of Academic Bullying: A Qualitative Study. Journal of Higher Education Theory & Practice. 2022;22(11): 79-88.
45. Einarsen S, Hoel H, Notelaers G. Measuring exposure to bullying and harassment at work: Validity, factor structure and psychometric properties of the Negative Acts Questionnaire-Revised. Work & stress. 2009;23(1):24-44.

46. Alqahtani N. Bullying in the Academic work Environment at King Saud University from the Perspective of the Faculty Members. Dirasat: Human and Social Sciences. 2023;50(2): 539-52. doi: 10.35516/hum.v50i2.4960.
47. Iyer MS, Way DP, MacDowell D, Overholser B, Jagsi R, Spector ND. Disrupting faculty-on-faculty bullying in academic medicine: an innovative workshop. MedEdPORTAL. 2023 Oct 3:19:11352. doi: 10.15766/mep_2374-8265.11352. [PMID: 37795259] [PMCID: PMC10545817]
48. Migliaccio T, Rivas A, Rivas B, Stark R. Bullying within academia: A cultural and structural analysis. Learning, Culture and Social Interaction. 2024;44:100783. doi: 10.1016/j.lcsi.2023.100783.
49. Offer K, Rahwan Z, Hertwig R. Counteracting deliberate ignorance of academic bullying and harassment. Commun Psychol. 2023 Dec 9;1(1):38. doi: 10.1038/s44271-023-00044-7. [PMID: 39242959] [PMCID: PMC11332241]

Table 2. Search results for each database and number of findings by document type before duplication removal

Database	Document type by frequency								Total
	Article	Letter	Review	Editorial	Note	Book	Book chapter	Dissertation	
PubMed	10	4	2	2	-	-	-	-	18
Scopus	14	4	2	3	1	1	3	-	28
Web of science	14	3	2	2	1	-	-	-	22
Science direct	2	-	-	1	-	-	-	-	3
ProQuest	10	3	1	1	-	-	-	3	18
Total									89

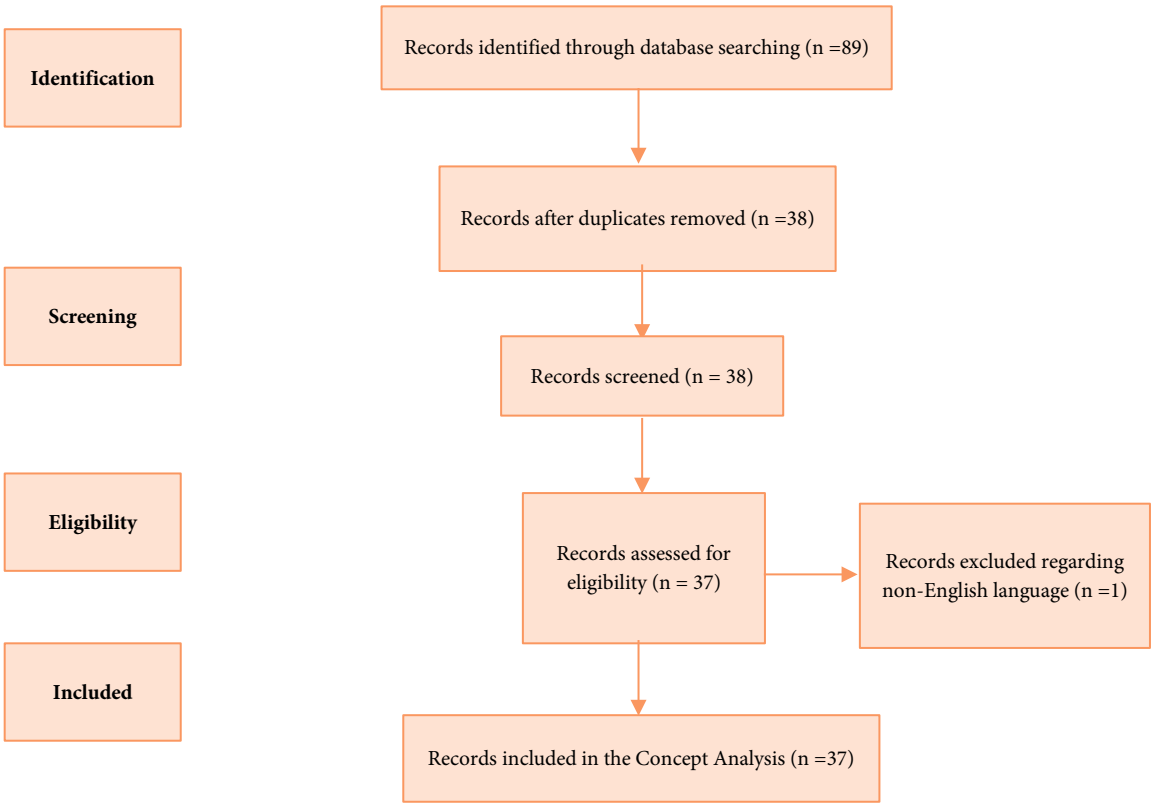

Figure 1. PRISMA flow diagram (Moher et al., 2009)

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Original Article

Medical Teachers' Entrustable Professional Activities for Clinical Education

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Abstract

Background: A medical teacher has a wide range of roles and responsibilities that vary from a medical teacher to a trainer and finally a clinical specialist. Most medical teachers receive limited training to prepare them to provide effective teaching and clinical supervision.

Objectives: The current study aims to develop core entrustable professional activities (EPAs) for medical teachers related to more effective clinical education.

Methods: This study was conducted in two phases. The first phase focused on defining an initial set of EPAs. The second phase focused on developing this set via a nominal group technique (NGT) among 30 faculty clinical specialties until a consensus was reached.

Results: The total of 29 EPAs in the five dimensions were agreed upon by more than 70% of the participants. Most of the activities were identified in the curriculum planning activities (n=11). Further details on the characteristics identified in each of the five dimensions of the EPAs are provided.

Conclusion: By adopting EPAs and a structured competency framework for educators, the quality of teaching and subsequently the learning experiences of trainees can be significantly improved, ultimately benefitting patient care.

Keywords: Entrustable Professional Activities; Faculty Development; Nominal Group Technique; Medical Teachers; Competencies

Background

The institutions try to improve or develop the competencies of medical teachers in their current responsibilities and continuously upgrade and redefine their competencies (1). A medical teacher has a wide range of roles and responsibilities that vary from a medical teacher to a trainer and finally a clinical specialist (2). Most medical teachers receive limited training to prepare them to provide effective teaching and clinical supervision (3). It has been observed that they often deal with problems in effectively carrying out their academic responsibilities due to the lack of training (4-6). Furthermore, evidence shows that medical teachers have insufficiently prepared across traditional competencies of medical knowledge, clinical skills, professionalism, and newer competencies of evidence-based practice, quality improvement, interdisciplinary teamwork, and systems to perform their functions effectively (7). Indeed, attaining a qualified medical teacher has been associated with developing many roles, leadership positions, and responsibilities in medical education (1). However, if they see proper educational programs in this regard, they will definitely become better teachers (3).

Entrustable professional activities (EPAs) are units of professional activities, i.e., tasks or responsibilities that can be implemented, observed, and measured independently in terms of procedures and outcomes, and when an individual acquires sufficient competencies (1). Fitzgerald (2016) stated that educational methods, curriculum development, teaching community, evaluation, and leadership skills are competencies of medical teachers required for achieving EPA-based competence (2). Iqbal et al. (2018)

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reviewed existing medical teacher education programs that incorporated EPAs in their frameworks to provide further insights into how the EPA concept is adopted (3). Furthermore, according to Iqbal (2019), EPAs can serve as a new framework for planning and implementing structured programs for faculty development and evaluating the skills of small-group facilitators after training (4). Van Dam et al. (2021) used EPAS to improve teaching at the patient's bedside, including preparation, a safe learning environment, flexible teaching, and patient benefits, and introduced a description of structured EPAs (5). Van Bruggen et al. (2022) developed a set of nine EPAs as a foundation for improving the initial and continuous professional development of university teachers in health professions education (6). It appears that existing frameworks of EPAs for medical teachers are limited. While previous educational environment frameworks have focused on various dimensions such as teaching and learning, few have adequately integrated assessment as a critical component affecting students' perceptions (7). The research highlights a specific decline in positive perceptions of the educational environment during clinical years, which appears to be underexplored in current frameworks. Most existing studies tend to generalize findings across all phases of medical education without delineating the unique challenges and experiences faced by students in clinical settings (8, 9). The development of a holistic educational environment framework that encompasses personal development, teaching methods, assessment, facilities, support systems, and curriculum is rare (10-12). Although they may successfully meet the requirements of a longitudinal training program, they do not clearly describe the activities and competencies required for comprehensive roles for a medical teacher. Indeed, the effort to implement effective faculty development programs for medical teachers to provide effective clinical education with the aim of assessing, training, and reassessing their competencies indicates the necessity of developing a comprehensive, flexible, and context-based framework. This is an entrustable professional activities framework for medical teachers that includes both personal and professional competencies and is needed for a teacher's academic activities. Furthermore, it also helps medical teachers who are looking for ways to increase student achievement, which could serve as a foundation for teaching and qualification competencies and professional opportunities.

Objectives

The current study aims to develop core entrustable professional activities (EPAs) for medical teachers related to more effective clinical education.

Methods

This study was conducted in two phases. The first phase focused on defining an initial set of EPAs. The second phase focused on developing this set via a Nominal Group Technique (NGT) among medical teachers until consensus was reached. The ethics committee of the National Center for Strategic Research in Medical Education approved the protocol for this study (IR.NASRME.REC.1400.505).

Development of initial EPAs: The initial list of EPAs was used using the frameworks suggested in previous studies (13-16), as well as the list of competencies related to the faculty development program (FD) for faculty members for essential competencies of medical education at Kerman University of Medical Sciences (KUMS), and the initial list included 62 activities (Appendix 1).

Study design and setting: This NGT study was conducted on clinical specialties affiliated with the KUMS who were invited to a nominal group technique meeting in 2023.

Participants: In the first phase of the study, a nominal group meeting, 15 clinicians participated. In the study's second phase, which was the voting stage for the qualifications obtained from the first phase, 32 clinicians working at Afzalipour Hospital participated. The criterion for enrollment in the study was at least five years of work experience in clinical education (13, 14).

Data collection: The NGT proposed by Humphrey Morto et al. (2017) with modifications of stage four (voting) was used to identify and reach a consensus about the most important EPAs of medical teachers (13). The participants were provided with instructions about the concept of EPA and related examples during the meeting, and the consent form was also sent in printed form. The NGT meeting was held at one of the KUMS-affiliated hospitals in September 2023 and was managed by a medical education specialist (S.S).

In the first stage, silent idea generation, the purpose and procedures of the meeting, and a brief overview of the EPA concept were presented by one of the authors. a list of initial ideas was provided to participants and shown by a video projector (Appendix 1). Participants were asked to write their ideas independently and silently in response to questions written on the papers

given to them. At this stage, participants were not permitted to discuss their answers with others. The participants were expected to determine the EPAs required by medical teachers in clinical education to train competent medical graduates; this step took ten minutes.

In the Round-Robin recording of ideas, The Facilitator invited participants to share the ideas they generated while the facilitator wrote them down. Participants were encouraged to use other participants' responses to write new ideas that may not have been considered in the previous round. All responses were typed word-by-word in Word Office@2016 (Microsoft Corporation, Redmond, Washington, USA) by a medical education specialist and simultaneously displayed to the participants using a video projector. During these steps, the number of responses was not limited; the participants could list as many activities as they wanted. This step took 30 minutes to complete.

In the group discussion stage, the facilitator briefly discussed each suggested item to clarify the ideas proposed by the team of clinical experts for the initial assessment and consolidate similar responses without any judgment or criticism. Participants discussed verbal explanations or more details about any ideas that colleagues generated, which may not have been clear to them. The facilitator allowed people to participate and discuss all ideas to avoid spending too much time on one idea. In this step, necessary efforts were made to neutralize, and judgment and criticism were avoided. At this stage, new ideas were suggested for discussion and items were combined into categories, but no ideas were eliminated. This step took 40 minutes to complete.

In the ranking of ideas step, participants were asked to prioritize each item. They were then asked to evaluate the importance of each EPA on a five-point scale (unimportant = 1, very important = 5). If the participants did not agree with the ideas, the next idea was discussed. The ideas were sorted based on the score they received from the participants, and the priority list reflected group consensus.

In the Tally of the ranking step, the ideas that received too many and too few votes in the previous step were discussed. The purpose of this step was to finalize ideas for important EPAs for medical teachers. In this step, an agreement was reached on the ideas that should be eliminated, and the ideas that received a good score were evaluated in the next step.

In the final step, the ranking review was completed in the next session because of the workplace of the clinical teachers (participants in the nominal group). Therefore, the classified activities in the form of a questionnaire were presented to the participants of the NGT meeting in person at the Afzalipoor Educational Hospital, and they were asked to evaluate the importance of each EPA. Questionnaires were distributed and collected (Figure 1).

Data analysis: Quantitative and qualitative methods were used to analyze the data collected during the NGT meeting. For qualitative analysis, the first author (S.S) read and reread the narratives and extracted relevant characteristics. Then, another author (A.A) independently reviewed the initial coding procedure. Two authors discussed and agreed on the extracted characteristics. The extracted characteristics were merged based on similarities and then grouped into dimensions using a previously described framework (15). The characteristics of a medical teacher with some examples of the participants' quotes. The characteristics and dimensions were revised by other authors (M.O and M.I.).

In the quantitative analysis phase, descriptive statistics, including frequency, mean, and standard deviation, were calculated using Microsoft Excel 2016 (Microsoft Corporation, Redmond, Washington) to summarize the raw data collected from the voting phase. The frequency of votes was calculated to report the level of consensus, and the mean values were calculated based on the number of participants as well as a measure of dispersion to report the importance of rating each characteristic.

The consensus was defined as 70% agreement for ratings 4 (important) and 5 (very important) (13). In addition, an existing valid framework (O'Neill's framework) was used to classify medical teacher activities (15).

Results

Thirty-two specialists in internal medicine, general surgery, obstetrics and gynecology, and dermatology voluntarily participated in the three-hour NGT session (Table 1). A total of 32 participants completed the questionnaire in the voting phase. Moreover, 16 participants (50%) in the NGT meeting and the voting stage were female; internal medicine had the highest clinical teaching experience among the participants.

In the qualitative analysis phase, a total of 62 competencies were classified in the five dimensions as

examples of quotes (Table 2). After quantitative analysis, 29 EPAs in the five dimensions were agreed upon by more than 70% of the participants. Most of the activities were identified in the curriculum planning activities (n=11) (Table 3). Further details on the characteristics identified in each of the five dimensions (Table 4).

Discussion

The findings of this research showed five domains and 29 entrustable professional activities for medical teachers. These dimensions were curriculum planning, applying technology enhanced, developing effective communication skills, developing professional activities, and conducting scholarship teaching of learning. Among the strengths of this study is the presentation of a general framework with EPAs that was developed in collaboration with medical educators who were closely familiar with the strengths, challenges and needs of medical teachers. In addition, due to the limited evidence regarding the development of EPAs for medical teachers, this research will help to improve the existing evidence.

Similarly, Srinivasan et al. (2011) identified a set of competencies for effective medical teachers in addition to teaching skills (16). Groupon et al. (2016) used competency-based education and EPAs in the curriculum for the Master's program in health professions. They used EPAs to determine the duties of medical education professionals in competency classifications such as teaching theory, curriculum development, and evaluation (17). Dewey et al. (2017) also suggested early EPAs such as trainee skill assessment, mentoring, individual or small group instruction, large group instruction, and learner-centered clinical learning and indicated that a faculty member must be assessed for competency in EPAs before beginning their role as a teacher (13). As Rosenbaum (2012) described, medical teachers in any setting need content knowledge, learner-centeredness, professionalism, communication, practice-based reflection, and systems-based practice (18).

The findings from this study show that the EPAs of medical teachers were related to their competencies in using advanced technologies in medical education. Much evidence points to the increasing importance of technology in medical education. Technology can enhance learning by providing interactive and engaging experiences for medical students, as well as improving access to educational resources. the potential benefits of using technology to simulate medical procedures and scenarios, allowing students to gain practical experience in a safe and controlled environment (19). Virtual reality (VR) in medical education can be used to simulate medical procedures and scenarios, allowing students to practice and develop their skills in a realistic environment (20). Gamification can be used to engage students and make learning more enjoyable while also promoting critical thinking and problem-solving skills. the potential benefit of using gamification for medical simulations, is that it allows students to practice decision-making and teamwork in a fun and interactive way (21). Furthermore, many educators may not feel comfortable or confident using new technologies and may require training and support to effectively integrate them into their teaching. the potential benefits of providing a continuum of professional development opportunities for faculty, such as workshops, conferences, and online courses (22). Bray et al. (2020) proposed a systematic approach to faculty development with the desire to be flexible and reach potential participants, and using the existing infrastructure can facilitate the participation of evaluators in the new evaluation culture. Moreover, the interaction between the participants during the training sessions not only promoted their learning but also created cooperation to build a group (23).

Although the available evidence to express the competencies needed by medical professors in new technologies is limited, due to the advancement of technology in medicine, the required competencies of medical teachers have also changed. Suitable strategies for improving it, such as involving stakeholders in the decision-making process, providing clear communication and training, and ensuring that technology is aligned with educational goals and outcomes (24). Medical teachers must have the ability to use new technologies and be able to turn them into practical applications in the education of medical students. In addition, they must have the technical and analytical abilities necessary to evaluate and choose appropriate technologies for teaching students. Additionally, they must have the necessary management skills to implement educational programs using technology.

Furthermore, the findings of the present study indicated that effective communication skills and the role modeling of professional behavior improve the effectiveness of clinical education. Medical educators' communication skills in clinical education play an

important role in creating a positive and safe learning climate for students, leading to a happy and motivating environment for students, which improves student learning. Bremer et al. (2021) reported 5 EPAs for medical educators, including medical consultation, medical procedures, guidance and education, communication and collaboration, and nonclinical activities (25). One of the core activities for medical teachers was curriculum planning, leading to the effectiveness of clinical education. Curriculum planning involves clinical training course planning and implementation, which gives meaning to this field. Furthermore, this study highlighted evaluation and scholarship as one of the aspects of EPAs, improving the effectiveness of clinical education. Boyer (1990) defined universities as knowledge institutions in which knowledge activities (production, management, transfer, and application of knowledge) take place. According to Boyer's definition, university faculty members, as knowledge activists, should provide the four knowledge activities in a proportionate manner (26).

It seems that providing FD programs and EPAs based on medical teachers at levels appropriate to the context and their level of competence in teaching can be a way forward. Medical teachers whose teaching is a reliable aspect of their professional work should be assessed, trained, and periodically reassessed to determine if they maintain their qualifications. In this regard, EPAs have been proposed that will lead to the professional development of medical teachers and provide the best possible education for learners (13). Steinert (2006) states that medical teachers should be trained in areas such as teaching, barriers to successful teaching, competency-based assessment, hidden curriculum, educational technology, and scholarship of teaching and learning (SOTLs) (27). Additionally, in another article, he considers a successful FD program to include professional development, teaching, organizational development, and program evaluation (28). McLean et al. (2008) have pointed to things such as higher education, curriculum, research knowledge, leadership and professional development, and teaching methods (29). Trowbridge & Bates (2008) refers to things such as improving teaching and learning, clinical skills, professional development, performance management techniques, and research skills (30). Eventually, since the present study examined the features of EPAs and the necessary capabilities of medical education for medical teachers, the extracted EPAs can be suitable options for evaluating and FD for medical teachers.

One limitation of this article is its focus on studying in one center and a small number of medical teachers. If it is conducted with the participation of several centers and internationally, better results will be achieved. Second, there was a lack of familiarity among medical teachers with EPAs before conducting this study, which requires providing educational lectures on this topic.

Conclusion

This study advocates for a competency-based medical education (CBME) approach, which includes evaluating specific teaching EPAs to ensure that faculty are adequately prepared to supervise and educate trainees. Moreover, continuous professional development in medical education for faculty emphasizes that updates and evaluations of teaching competence should be part of their ongoing professional journey. By adopting EPAs and a structured competency framework for educators, the quality of teaching and the subsequent learning experiences of trainees can be significantly improved, ultimately benefiting patient care. The paper acknowledges potential barriers to implementing such a framework, including time constraints and the financial implications for institutions, but emphasizes that these challenges can be overcome with proper planning and commitment.

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Conflict of interests: There is no conflict of interest.

Ethical approval: Ethics approval and consent to participate All study protocols were conducted under approval of the Ethics Committee of National Center for Strategic Research in Medical Education (Ethics code: IR.NASRME.REC.1400.505). All methods were carried out in accordance with relevant guidelines and regulations. The participation of medical teachers was completely voluntary, and informed consent was obtained from all participants.

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References

1. Ten Cate O. Entrustability of professional activities and competency-bases training. Med Educ. 2005 Dec;39(12):1176-7. doi: 10.1111/j.1365-2929.2005.02341.x. [PMID: 16313574]
2. Fitzgerald JT, Burkhardt JC, Kasten SJ, Mullan PB, Santen SA, Sheets KJ, et al. Assessment challenges in competency-based education: A case study in health professions education. Med Teach. 2016 May; 38(5): 482-90. doi: 10.3109/0142159X.2015.1047754. [PMID: 26052881]
3. Iqbal MZ, Al-Eraky MM, AlSheikh MH. Designing entrustable professional activities for training health professional educators: A review of current practices. Medical Science Educator. 2018;28(4):797-802. doi: 10.1007/s40670-018-0623-5.
4. Iqbal MZ, Könings KD, Al-Eraky M, AlSheikh MH, van Merrienboer JJ. Development of an entrustable professional activities (EPAs) framework for small group facilitators through a participatory design approach. Med Educ Online. 2020 Dec; 25(1): 1694309. doi: 10.1080/10872981.2019.1694309. [PMID: 31876251] [PMCID: PMC6968595]
5. van Dam M, Ramani S, Ten Cate O. An EPA for better bedside teaching. Clin Teach. 2021 Aug; 18(4): 398-403. doi: 10.1111/tct.13346. [PMID: 33763984] [PMCID: PMC8451813]
6. van Bruggen L, van Dijk EE, van der Schaaf M, Kluijtmans M, Ten Cate O. Developing entrustable professional activities for university teachers in the health professions. Med Teach. 2022 Apr; 44(4): 425-32. doi: 10.1080/0142159X.2021.1998402. [PMID: 34767494]
7. Roslan NS, Mohammad JA-M, Ismai MA-A, Ahmad A, Yusoff MSB. Rethinking Education Environment: The Clinical Education Environment Framework. Education in Medicine Journal. 2018; 10(3): 31-46. doi: 10.21315/eimj2018.10.3.4.
8. Roff S, McAleer S, Harden RM, Al-Qahtani M, Ahmed AU, Deza H, et al. Development and validation of the Dundee ready education environment measure (DREEM). Medical Teacher. 1997; 19(4): 295-9. doi: 10.3109/01421599709034208.
9. Aghamolaei T, Shirazi M, Dadgaran I, Shahsavari H, Ghanbarnejad A. Health students' expectations of the ideal educational environment: a qualitative research. J Adv Med Educ Prof. 2014 Oct; 2(4): 151-7. doi: 10.9734/BJMMR/2014/8078. [PMID: 25512939] [PMCID: PMC4235565]
10. Schönrock-Adema J, Bouwkamp-Timmer T, van Hell EA, Cohen-Schotanus J. Key elements in assessing the educational environment: where is the theory? Adv Health Sci Educ Theory Pract. 2012 Dec; 17(5): 727-42. doi: 10.1007/s10459-011-9346-8. [PMID: 22307806] [PMCID: PMC3490064]
11. Abraham R, Ramnarayan K, Vinod P, Torke S. Students' perceptions of learning environment in an Indian medical school. BMC Med Educ. 2008 Apr 11: 8: 20. doi: 10.1186/1472-6920-8-20. [PMID: 18402710] [PMCID: PMC2329622]
12. Soemantri D, Herrera C, Riquelme A. Measuring the educational environment in health professions studies: a systematic review. Med Teach. 2010; 32(12): 947-52. doi: 10.3109/01421591003686229. [PMID: 21090946]
13. Dewey CM, Jonker G, Ten Cate O, Turner TL. Entrustable professional activities (EPAs) for teachers in medical education: has the time come? Med Teach. 2017 Aug; 39(8): 894-896. doi: 10.1080/0142159X.2016.1270447. [PMID: 28027689]
14. Holmboe ES, Ward DS, Reznick RK, Katsufrakis PJ, Leslie KM, Patel VL, et al. Faculty development in assessment: The missing link in competency-based medical education. Acad Med. 2011 Apr; 86(4): 460-7. doi: 10.1097/ACM.0b013e31820cb2a7. [PMID: 21346509]
15. Sherbino J, Frank JR, Snell L. Defining the key roles and competencies of the clinician–educator of the 21st century: A national mixed-methods study. Acad Med. 2014 May;89(5):783-9. doi: 10.1097/ACM.0000000000000217. [PMID: 24667507]
16. Srinivasan M, Li S-TT, Meyers FJ, Pratt DD, Collins JB, Braddock C, et al. Teaching as a competency: competencies for medical educators. Acad Med. 2011 Oct;86(10):1211-20. doi: 10.1097/ACM.0b013e31822c5b9a. [PMID: 21869655]
17. Gruppen LD, Burkhardt JC, Fitzgerald JT, Funnell M, Haftel HM, Lypson ML, et al. Competency-based education: programme design and challenges to implementation. Med Educ. 2016 May; 50(5): 532-9. doi: 10.1111/medu.12977. [PMID: 27072442]
18. Rosenbaum M. Competencies for medical teachers. In SGIM Forum. 2012; 35(9): 2-3.
19. Clarke E, Burns J, Bruen C, Crehan M, Smyth E, Pawlikowska T. The 'connectaholic'behind the curtain: medical student use of computer devices in the clinical setting and the influence of patients. BMC Med Educ. 2019 Oct 17;19(1):376. doi: 10.1186/s12909-019-1811-8. [PMID: 31623637] [PMCID: PMC6798481]
20. Dyer E, Swartzlander BJ, Gugliucci MR. Using virtual reality in medical education to teach empathy. J Med Libr Assoc. 2018 Oct;106(4):498-500. doi: 10.5195/jmla.2018.518. [PMID: 30271295] [PMCID: PMC6148621]
21. Brown LO, Koptelov A, Novikova N, Nekrasova G, Dombiev H. Innovative Trends and Approaches in Integrating Technology in Education: An International Comparison. Journal of Universality of Global Education Issues. 2020;6(1): 1-20.
22. Hartman RJ, Townsend MB, Jackson M. Educators' perceptions of technology integration into the classroom: a descriptive case study. Journal of Research in Innovative Teaching. 2019; 12(3): 236-49. doi: 10.1108/JRIT-03-2019-0044.
23. Bray MJ, Bradley EB, Martindale JR, Gusic ME. Implementing Systematic Faculty Development to Support an EPA-Based Program of Assessment: Strategies, Outcomes, and Lessons Learned. Teach Learn Med. 2021 Aug-Sep;33(4):434-444. doi: 10.1080/10401334.2020.1857256. [PMID: 33331171]
24. Jang HW, Kim K-JJBme. Use of online clinical videos for clinical skills training for medical students: benefits and challenges. BMC Med Educ. 2014 Mar 21:14:56. doi: 10.1186/1472-6920-14-56. [PMID: 24650290] [PMCID: PMC3994418]
25. Bremer AE, van de Pol MH, Laan RF, Fluit CR. How an EPA-based curriculum supports professional identity formation. BMC Med Educ. 2022 Jan 20;22(1):48. doi: 10.1186/s12909-022-03116-0. [PMID: 35057788] [PMCID: PMC8781044]
26. Boyer EL. Scholarship reconsidered: Priorities of the professoriate. John Wiley & Sons; New York.
27. Steinert Y. Commentary: Faculty development: The road less traveled. Academic Medicine. 2011;86(4):409-11.
28. Steinert Y, Mann K, Centeno A, Dolmans D, Spencer J, Gelula M, et al. A systematic review of faculty development initiatives designed to improve teaching effectiveness in medical education: BEME Guide No. 8. Med Teach. 2006 Sep;28(6):497-526. doi: 10.1080/01421590600902976. [PMID: 17074699]
29. McLean M, Cilliers F, Van Wyk JM. Faculty development: yesterday, today and tomorrow. Med Teach. 2008;30(6):555-84. doi: 10.1080/01421590802109834. [PMID: 18677659]
30. Trowbridge RL, Bates PW. A successful approach to faculty development at an independent academic medical center. Medical Teacher. 2008;30(1):e10-e4. doi: 10.1080/01421590701753435.

Figure 1. Nominal group technique steps to develop entrustable professional activities for medical teachers

Table 1. The participants' demographic characteristics

Specialty	NGT session		Voting session	
	Number (female/male)	%	Number (female/male)	%
General surgery	4 (2/2)	27	6 (2/4)	18.75
Internal medicine	6 (4/2)	40	16 (6/8)	50
Obstetrics and Gynecology	2(2/0)	13	6 (6/0)	18.75
Dermatology	3 (1/2)	20	4(2/2)	12.5
Total	15	100	32	100

Table 2. The dimensions of medical teacher characteristics and examples of the participants' quotes related to EPAs

Dimensions of medical teacher characteristics	Examples of quotes
Curriculum planning	"A teacher must be capable enough to develop their own lesson and course plans based on the curriculum". "A teacher should be able to use appropriate teaching methods according to the nature of the course and not convey everything to the medical student through lectures". "At the beginning of the course, the teachers should make all the necessary arrangements to offer the course in the best way possible". "In addition to teaching students, the teacher should lead them to lifelong learning and help the students as a supporter". "The teacher teaches essential content and assesses each learner's abilities in their area of expertise". "Teachers should regularly update their knowledge and constantly engage in identifying the latest scientific articles and sources". "Teachers are always known for their effective teaching, and students participate in their classes with great interest".
Developing effective communication skills, and role modeling	"The teacher demonstrates a commitment both to learner success and to helping them grow in their professional roles". "The teacher demonstrates the best behavior as a model for the learners and sets those behaviors as a model for them".
Scholarship teaching of learning	"The teacher demonstrates continuous self-evaluation and ongoing training to improve one's effectiveness and capacity as a medical teacher". "The teacher is not aloof to the students' issues and problems but tries to make them empowered to confront their problems".
Evaluation and scholarship	"The teacher continuously seeks to evaluate the educational environment and solve challenges and tries to increase the quality of clinical education". "The teacher is familiar with educational scholarship and identifies clinical education issues, and publishes the results of their work".

Table 3. The dimensions and number of the generated and agreed characteristics of medical teachers

Dimensions	Generated competencies(n=62)		Agreed EPAs(n=29)	
	Positive	Negative	Positive	Negative
Curriculum planning	13	4	11	2 (Merged)
Applying advanced enhance technologies	6	3	5	1 (Merged)
Developing effective communication skills, and role modeling	5	3	4	1 (Deleted)
Developing Professional activities	7	7	4	3 (Merged)
Conducting scholarship teaching of learning	8	7	5	3 (Merged & deleted)
Total	39	23	29	10

Table 4. The consensus level of EPAs of medical teachers

Dimensions		EPAs	Consensus level	
			%	Mean (SD)
Curriculum planning	EPA1	Determining and implementing educational goals (aim and objective) based on the curriculum,	100	4.53(0.49)
	EPA2	Compilation and implementation of the course and lesson plans	84.61	4.23(0.69)
	EPA3	Implementation of the appropriate teaching methods	76.99	3.69(0.82)
	EPA4	Collaboration with other colleagues in curriculum planning	100	4.46(0.49)
	EPA5	Management of the appropriate learning environment	100	4.30(0.46)
	EPA6	Providing effective feedback	100	4.23(0.46)
	EPA7	Evaluating the academic achievement of the trainee	100	4.23(0.42)
	EPA8	Producing a good learning environment for learners	99.1	4.18(0.51)
	EPA9	Facilitating learning along with high-quality patient care	84.61	4.07(0.61)
	EPA10	Implementation of appropriate assessment methods	92.30	4.15(0.53)
	EPA11	Conducting of quantitative and qualitative analysis techniques to analyze test results	76.92	4.07(0.72)
Applying advanced enhance technologies	EPA1	Conducting e-learning and hybrid teaching strategies in clinical education	76.92	4.15(0.76)
	EPA2	Instructional designing based on new technologies in medical education	92.30	4.00(0.78)
	EPA3	Applying digital technologies in training, assessment and promotes rich learning experiences for trainees	76.92	4.00(0.67)
	EPA4	Developing knowledge, and skills in applying technologies enhancement,	76.92	4.07(0.72)
Developing effective communication skills, and role modeling	EPA1	Implementing the principles of professionalism in training,	84.61	4.15(0.66)
	EPA2	Counseling on dysfunction, personal crises, and professional issues to trainees	92.30	4.30(0.60)
	EPA3	Planning, directing, and supervising to train professionalism and effective communication skills with patients	84.61	4.23(0.69)
	EPA4	Mentoring in training professionalism programs, in parallel	92.30	4.00(0.39)
	EPA5	Identifying and reinforce the learning, skills, and behaviors	76.92	3.92(0.91)
Developing Professional activities	EPA1	Identifying strengths and weaknesses in teaching	84.61	4.00(0.78)
	EPA2	Applying results of assessing the teaching effectiveness	84.61	4.07(0.61)
	EPA3	Participating in faculty development (FD) and Continuing Professional Development (CPD)	100	4.53(0.49)
	EPA4	Monitoring and Reviewing advancement of knowledge in the specialized discipline	84.61	4.23(0.69)
	EPA5	Directing professional support programs	84.61	4.07(0.61)
Scholarship teaching of learning	EPA1	Evaluating the educational environment	92.30	4.53(0.63)
	EPA2	Planning to resolve or reduce challenges and problems in the clinical setting	84.61	4.53(0.74)
	EPA3	Writing, introducing, and communicating scholarship in teaching and learning activities	76.92	4.00(0.67)
	EPA4	Sharing and publishing the results of scholarship activities in scientific reports format	92.30	4.46(0.63)

Appendix 1. List of Articles for medical teacher's competencies

Categories	Competencies
Curriculum Planning	1. Clinical teaching (Heflin et al. 2009) 2. Commitment to teaching (Walter et al. 2018) 3. Excellence in teaching practice (Sawatzky et al. 2009) 4. Facilitating (learning, professional development, assessment) (Ross and Stenfors-Hayes 2008) 5. Curriculum design and instruction (Tucker 2017) 6. Curriculum developer and implementer (Harden R. M. and Lilley 2018) 7. Curriculum design (Poindexter 2013) 8. Development (of learning content) (Molenaar et al. 2009)
Assessment of Learning	1. Assess student performance (Walter et al. 2018) 2. Assessment and evaluation (Robinson 2009; Poindexter 2013) 3. Assessment and evaluation of students and programmes (WHO 2013) 4. Assessment and feedback (EURACT 2012; Bearman et al. 2018; Chuenjitwongsa et al. 2018) 5. Assessing learning (Tucker 2017) 6. Assessor and diagnostician (Harden R. M. and Lilley 2018) 7. Enhancing learning through assessment (Academy of Medical Educators 2010; London Deanery 2014; Royal College of Surgeons of Edinburgh 2018, 2019)
Educational Research and Scholarship	1. Being a professional educator and trainer (Royal College of Surgeons of Edinburgh 2019) 2. Being a researcher (Ahmady et al. 2020) 3. Champion for scientific enquiry (Harper and Maloney 2017) 4. Educational research and scholarship (Academy of Medical Educators 2014) 5. Educational scholarship (Heflin et al. 2009; Graziano et al. 2019) 6. Excellence in teaching scholarship (Sawatzky et al. 2009) 7. Learning and community building (professional development, building institutional links,research) (Ross and Stenfors-Hayes 2008) 8. Pedagogical (knowledge and practice) (Zlatanovic et al. 2017) 9. Scholarship and leadership (Wyman et al. 2019) Scholarship of teaching and learning (Tucker 2017)
Educational Leadership and Management	1. Academic executive management and educational leadership (Ahmady et al. 2020) 2. Educational leadership (Graziano et al. 2019) 3. Educational leadership and management (Royal Australasian College of Physicians 2018) 4. Excellence in teaching leadership (Sawatzky et al. 2009) 5. Leadership and collaboration (Poindexter 2013) 6. Leadership and management (Harris BJ et al. 2012; Keshmiri et al. 2019) Manager (Prideaux et al. 2000; Royal College of Physicians and Surgeons of Canada 2013; Zeitoun et al. 2020)
Communication and collaboration	1. Active collaboration (Walter et al. 2018) 2. Change agent (Harper and Maloney 2017) 3. Communication skills (Moynihan et al. 2015; Zaweski et al. 2019) 4. Interpersonal skills and attributes (Bearman et al. 2018) 5. Advocate and positive role model (Wyman et al. 2019) 6. Attitudes (personal characteristics and professionalism) (Zlatanovic et al. 2017) 7. Being a professional educator and trainer (Royal College of Surgeons of Edinburgh 2019) 8. Professional relationships (with learners) (Walter et al. 2018) 9. Professional responsibility (Knox et al. 2020) 10. Advocacy (mentoring and supporting learners) (Russo et al. 2019) 11. Information provider and coach (Harden R. M. and Lilley 2018) 12. Mentoring and advising (Graziano et al. 2019) 13. Mentoring and guiding personal and professional development (Royal College of Surgeons of Edinburgh 2019) 14. Mentorship (Srinivasan et al. 2011; Zaweski et al. 2019) 15. Role model / practitioner / mentor (Zeitoun et al. 2020) Supervisor / facilitator / coach / teacher (Zeitoun et al. 2020)
Educational Environment, Quality, and Safety	1. Adapt to student learning needs (Walter et al. 2018) 2. Establishing and maintaining an environment for learning (Academy of Medical Educators 2010; London Deanery 2014; Royal College of Surgeons of Edinburgh 2018)

	3. Ethical thinking skills (Moynihan et al. 2015) 4. Learner centeredness (Srinivasan et al. 2011; G♀rlitz et al. 2015; Brink et al. 2018; Zaweski et al. 2019) 5. Learners and learning (Gardner et al. 2017) 6. Learning environment (Knox et al. 2020) Supporting and monitoring progress (Royal College of Surgeons of Edinburgh 2019)
Clinical skills and patient safety	1. Care management (Harris DL et al. 2007) 2. Clinical expertise (Bearman et al. 2018) 3. Ensuring safe and effective patient care through training (Academy of Medical Educators 2010; London Deanery 2014; Royal College of Surgeons of Edinburgh 2018) 4. Knowledge of determinants affecting health (Moynihan et al. 2015) 5. Promote quality and safety patient management (Olivares et al. 2017)
Categories	Competencies
Curriculum Planning	1. Clinical teaching (Heflin et al. 2009) 2. Commitment to teaching (Walter et al. 2018) 3. Excellence in teaching practice (Sawatzky et al. 2009) 4. Facilitating (learning, professional development, assessment) (Ross and Stenfors-Hayes 2008) 5. Curriculum design and instruction (Tucker 2017) 6. Curriculum developer and implementer (Harden R. M. and Lilley 2018) 7. Curriculum design (Poindexter 2013) 8. Development (of learning content) (Molenaar et al. 2009)
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Brief Report

Investigating the Effectiveness of Online Learning in the Post-Coronavirus (COVID-19) Era from the Perspectives of Students and Faculty Members of Selected Universities of Medical Sciences in Iran

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Abstract

Background: Online learning is a form of virtual learning that is being organized and implemented across universities of medical sciences in developing countries.

Objectives: The present study aimed to investigate the effectiveness of online learning from the perspectives of students and faculty members at selected universities of medical sciences in the post-coronavirus (COVID-19) era in Iran.

Methods: This descriptive-analytical study was conducted in 2023 at Zanjan University of Medical Sciences, Iran University of Medical Sciences, and Shahed University among faculty members and undergraduate students of nursing, midwifery, anesthesiology, and operating room. A stratified random sampling method and the Online Learning Effectiveness Assessment Questionnaire were employed in this study. Descriptive statistics and inferential statistical tests, such as Chi-square, Fisher's exact test, and Pearson's correlation coefficient, were used for data analysis.

Results: This study involved 286 students and 61 faculty members. From the perspectives of faculty members, online learning components, including teaching-learning activities, feedback, flexibility, assistance, motivation, and evaluation, demonstrated a desirable effectiveness, while the components of content, page design, and educational materials exhibited a moderate effectiveness. However, workload was deemed to have an undesirable effectiveness. From the students' perspectives, the components of content, teaching-learning activities, page design, feedback, workload, assistance, motivation, and evaluation were reported to have a desirable effectiveness, whereas educational materials and flexibility were reported to have an undesirable effectiveness.

Conclusion: The effectiveness of online learning in the post-COVID-19 era has been reported to be high among both students and faculty members. Given that online learning infrastructure was established compulsorily during the COVID-19 era and this method of instruction has not been abandoned in the post-COVID-19 era, its blended use with in-person instruction can enhance the quality of education among students and faculty members.

Keywords: Online Learning; Faculty Members; Students; University of Medical Sciences; Virtual learning; Post-Coronavirus Disease 2019

Background

Virtual learning is a form of distance learning in which the virtual space becomes the platform for teaching and learning (1). Online learning is a subset of virtual learning, encompassing an extensive set of technology applications and learning processes, such as computer-based learning, web-based learning, virtual classrooms, and digital interactions (2).

Given that online learning infrastructure has long been established for students and faculty members in

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developed countries, this method is still in its basic and initial stages of development and implementation in developing countries (3). With the outbreak of coronavirus disease 2019 (COVID-19), rapid changes occurred in virtual learning in developing countries, which mandated the use of online learning across various educational levels for both students and faculty members (4).

Among the most crucial benefits of online learning during and after the COVID-19 pandemic are flexibility, the elimination of unnecessary and costly commutes to attend in-person courses, and the absence of disruptive factors in learning, such as power-driven behaviors (5, 6). While the cost of conducting online courses is relatively low, their implementation necessitates appropriate computer equipment and the required software (7).

The results of various studies demonstrate that, alongside the advantages of online learning, its disadvantages comprise limitations in telecommunications and communication infrastructure, lack of access to computers and related services, insufficient time for faculty members to develop and present educational materials, reduced social interaction in online classes (8), lack of control over student cheating, and rapid changes in software systems (9-12).

With the outbreak of the COVID-19 pandemic, universities of medical sciences were compelled to shift to online learning. Given that the necessary infrastructure for this mode of instruction had not been effectively and efficiently established in developing countries, this shift culminated in significant challenges in university education, particularly in universities of medical sciences, for both students and faculty members (13).

Medical education, which is in direct relationship with patient life, is viewed as one of the most crucial pillars of maintaining public health (14) and must possess sufficient and perfect accuracy in terms of the quality and quantity of educational methods, particularly virtual and online learning (15). Given that the majority of educational courses in universities of medical sciences in Iran and worldwide involve clinical practice and bedside patient interaction, implementing this type of education online, with live question-and-answer sessions, necessitates an evaluation of the effectiveness of online learning presentation and the impact of this method compared to in-person bedside learning.

Due to the recognized importance of medical education, educational practices in Iran have been shifting toward innovation and the expansion of necessary infrastructure in the post-COVID-19 era (16). However, studies indicate that online medical education in the post-COVID-19 era still faces challenges in infrastructure, the teaching and evaluation process, ethics, and information security (17). Additionally, despite the increased utilization of online learning in medical sciences, fear and anxiety in the face of the complexities and unknowns of online learning as a significant barrier to the adoption of this method (18) and existing university rules and regulations have imposed limitations on its implementation (16).

Given the aforementioned points and the fact that most research on online medical education has focused on the COVID-19 era, the present research was conducted to investigate the effectiveness of online learning in the post-COVID-19 era from the perspectives of students and faculty members at selected universities of medical sciences in Iran.

Objectives

The present study aimed to investigate the effectiveness of online learning from the perspectives of students and faculty members at selected universities of medical sciences in the post-coronavirus (COVID-19) era in Iran.

Methods

Study Design: This descriptive-analytical study was conducted in 2023. The study population consisted of all faculty members and undergraduate students in nursing, midwifery, anesthesiology, and operating room from three universities of Zanjan University of Medical Sciences, Iran University of Medical Sciences, and Shahed University.

The total student population was 1500, and the total number of faculty members was 90. Based on Cochran's formula, and accounting for a 10% attrition rate, a sample of 286 students and 61 faculty members was selected.

Participants and Sampling: A stratified random sampling method was conducted among faculty members and students of nursing, midwifery, anesthesiology, and operating room from three universities of Zanjan University of Medical Sciences, Iran University of Medical Sciences, and Shahed University. The sample size was determined based on

Almahasees et al.'s (10) study, using a d-value of 5%, a 95% confidence level, a Z-value of 1.96, and p and q values of 0.5 (Equation 1).

(Equation 1) $$n = \frac{Nz^2pq}{Nd^2+z^2\,pq}$$

Inclusion criteria for faculty members included holding a minimum of a master's degree, having at least two semesters of experience in online learning for students, and a willingness to participate in the research. Questionnaires with at least 10% of questions left unanswered were considered an exclusion criterion.

Data Collection: The present study was approved by the Research Ethics Committee of Zanjan University of Medical Sciences. Through the Research Vice-Chancellor of Zanjan University of Medical Sciences, the necessary coordination was made with the Research Vice-Chancellors of Shahed and Iran Universities via correspondence. One collaborator from each university was invited to participate in the research. Initially, a list of faculty members and students at the specified levels was obtained from the education departments of the selected faculties. Subsequently, based on a systematic sampling method, and according to the calculated sample size for each field of study at each university, the names and details of the selected students were determined. The research collaborators provided the participants with the questionnaires while explaining the study's objective, complying with the principle of data confidentiality, and adhering to ethical considerations.

Instruments: The Online Learning Effectiveness Assessment Questionnaire in universities from the perspectives of both students and faculty members, designed by Taban and Yasini (2017), was employed in this study. The Cronbach's alpha coefficient for this questionnaire was determined to be 0.86 for students and 0.92 for faculty members (19). In the present research, the internal consistency method – Cronbach's alpha coefficient was used. Accordingly, the questionnaire was administered to 30 students and faculty members of the universities of medical sciences, and the Cronbach's alpha coefficient of the questionnaire was estimated to be 0.97 and 0.95, respectively. The questionnaire consisted of two sections: Demographic information pertaining to students, including age, gender, university of study, field of study, academic semester, ethnicity, place of residence, access to virtual learning resources, and family income level; and for another faculty members, including age, gender, education level, academic rank, participation in electronic learning (e-learning) courses, access to virtual learning resources, experience in virtual teaching, membership in the medical staff, and income status.

The section regarding the effectiveness of online learning delivery, from the perspectives of students and faculty members, consisted of questionnaires each containing 55 items and 10 domains, including content (items 1-7), teaching-learning activities (items 8-13), page design (items 14-20), educational materials (items 21-25), feedback (items 26-29), flexibility (items 30-34), workload (items 35-40), assistance (items 41-45), motivation (items 46-49), and evaluation (items 50-55). The questionnaire was scored on a 5-point Likert scale, ranging from very low (score 0) to very high (score 4). The questionnaire scores ranged from 0 to 220. Scores of 0 to 54 indicate a low effectiveness, 55 to 109 indicate a moderate effectiveness, 110 to 164 indicate a high effectiveness, and 165 to 220 indicate a very high effectiveness. The items in this questionnaire were developed based on the dimensions of online learning recommended by Greg Kearsley, whose validity and reliability have been confirmed (20). Moreover, the effectiveness was evaluated at the first level of Kirkpatrick's model (21).

Data Analysis: Following questionnaire collection, data were analyzed using SPSS version 24 (IBM Corporation, Armonk, NY). Descriptive statistics, including the mean, standard deviation, frequency, and percentage, were used to determine the effectiveness of online learning and its related domains. Fisher's exact test and the χ^2 test were also employed to assess the relationship between demographic qualitative variables and qualitative data. Additionally, Pearson's correlation coefficient was used to examine the relationship between demographic quantitative variables and quantitative data due to the normal distribution of the data. Finally, the data were analyzed using SPSS version 24. A $P < 0.05$ was considered statistically significant.

Results

In the present study, 286 students and 61 faculty members participated. The mean age of the students was 22.44 ± 2.20 years, their mean academic semester was 6.16 ± 1.56, the mean age of the faculty members was 44.18 ± 9.27 years, and their mean years of teaching experience was 14.36 ± 9.50 (Table 1).

In the current research, the majority of faculty members (72.1%) and students (54.2%) reported a high effectiveness of online learning delivery (Table 2).

From the faculty members' perspectives, the effectiveness of online learning delivery methods demonstrated a positive and desirable correlation with the components of teaching-learning activities, feedback, flexibility, assistance, motivation, and evaluation (due to correlation coefficients of 0.70 or higher) (r = 0.867, r = 0.775, r = 0.713, r = 0.762, r = 0.702, and r = 0.748, respectively), and a moderate correlation with the components of content, page design, and educational materials (r = 0.641, r = 0.624, and r = 0.548, respectively) (22).

Regarding workload, a negative correlation was reported (r = -0.632). From the students' perspective, the effectiveness of online learning regarding the components of content, teaching-learning activities, page design, feedback, workload, assistance, motivation, and evaluation had positive and desirable correlations (r = 0.822, r = 0.826, r = 0.822, r = 0.776, r = 0.832, r = 0.814, r = 0.706, and r = 0.850, respectively). However, regarding educational materials and flexibility, the correlation was negative (r = -0.704 and r = -0.656, respectively) (Table 3). Furthermore, from the students' perspectives, the highest mean effectiveness of online learning belonged to the flexibility component (16.35 ± 4.21), and the lowest belonged to the feedback component (6.59 ± 3.62). From the faculty members' perspectives, the highest mean effectiveness of online learning belonged to the page design component (19.62 ± 4.61), and the lowest belonged to the motivation component (7.96 ± 3.75). The total score of online learning effectiveness was reported as 111.60 ± 25.39 for students and 130.37 ± 25.90 for faculty members. In terms of the total score of the effectiveness questionnaire, both groups demonstrated a good level (Table 3).

Discussion

The present study aimed to investigate the effectiveness of online learning in the post-COVID-19 era from the perspectives of students and faculty members of selected universities of medical sciences in Iran. From the faculty members' perspectives, online learning had a desirable effectiveness regarding the components of "teaching-learning activities, feedback, flexibility, assistance, motivation, and evaluation," and a moderate effectiveness regarding the components of "content, page design, and educational materials." From the students' perspectives, online learning exhibited desirable effectiveness regarding the components of "content, teaching-learning activities, page design, feedback, workload, assistance, motivation, and evaluation," but a negative correlation was reported with the components of "flexibility and educational materials." In this context, the results of Yasini et al.'s study revealed that, from the faculty members' perspectives, the components of "course content, organization of educational materials, course flexibility, and workload" had a desirable effectiveness, while the components of "teaching-learning activities, web page design, feedback provided during the course, and student assistance" had a moderate effectiveness. From the students' perspectives regarding holding the online learning course, the effectiveness of the course content and page design was evaluated as desirable, the effectiveness of teaching-learning activities and student assistance as undesirable, and the effectiveness of organizing educational materials, provided feedback, and the flexibility of the educational course as moderate (19). This was partially inconsistent with the findings of the present study, which could be attributed to differences in the research population, the time of the study, and the improvement of required infrastructure of online learning in recent years. Additionally, most students who had previously been educated through traditional, in-person methods were reliant on limited resources for studying and exams. In contrast, online learning, due to its high flexibility for using up-to-date resources and student faster and easier access to educational resources, is possibly perceived as unfavorable due to learning overload.

The findings of Hammed et al.'s research demonstrated that the majority of students were satisfied with the number of online classes and their organization, content, and preparation.

Among various teaching methods, live online lectures were the most common, and most students preferred the use of this method (23). The results of the present study demonstrated that most students positively evaluated the teaching-learning activities and feedback in relation to effectiveness.

From the students' perspectives in the present study, the highest mean effectiveness of online learning belonged to the flexibility component, and the lowest belonged to the feedback component. From the faculty members' perspectives, the highest mean effectiveness of

online learning belonged to the page design component, and the lowest belonged to the motivation component.

As shown by the findings of Abbasi's research, the majority of faculty members agreed that the capability for magnifying visual elements on a separate page existed, and that the final media was compatible with various computers, operating systems, and browsers, and was acceptable to students (24). In this regard, the present study also indicated that, from the faculty members' perspectives, page design had a greater impact on online learning effectiveness compared to other components of online learning. In Zarei et al.'s study, the lack of an appropriate motivational system was identified as one of the obstacles to virtual learning, and the quality of virtual learning was reported to be lower than that of in-person instruction (25). In Abbasi et al.'s research, the level of student learning motivation using virtual methods during the COVID-19 pandemic was reported to be low (24). The results of the aforementioned studies (24, 25) aligned with the findings of the present study. In the present research, from the faculty members' perspectives, the lowest mean effectiveness of online learning belonged to the motivation component, which could be attributed to the reduced student interaction in online classes. Face-to-face interaction and the use of body language in traditional in-person classes are crucial for the quality of teaching and learning, and enhance information transfer, reception, analysis, and memorization in in-person settings (26).

In the current research, the majority of faculty members (72.1%) and students (54.2%) reported a high effectiveness regarding online learning delivery methods. In this regard, the results of Yasini et al.'s study revealed that faculty members perceived the content of the virtual learning course as having a desirable effectiveness, and among students, the effectiveness of the educational course content was also reported as desirable across all components (19). The findings of a study demonstrated that although online learning faced challenges, 50% of studies reported moderate satisfaction with distance learning, while 36% were highly satisfied and 17% were dissatisfied (11).

The results of a study conducted in Pakistan, which aimed to examine students' perceptions of e-learning during the COVID-19 pandemic, revealed that 77% of students held a negative view of e-learning (27). Additionally, according to the results of Abbasi et al.'s study, the use of online learning reduces professor-student interaction (24); whereas, in the present study, more than half of the students reported a high effectiveness of online learning. This discrepancy may be attributed to differences in the necessary infrastructure for virtual learning in different countries.

The limitations of the present study comprise the lack of generalizability of the findings to other educational disciplines and populations, particularly to first-world countries (given their greater expertise in virtual learning infrastructure compared to other nations), and the lack of investigation into various online learning methodologies due to time and financial constraints. Therefore, it is recommended that future studies explore online learning across diverse academic disciplines and populations.

Conclusion

The suspension of in-person classes at universities of medical sciences due to the COVID-19 pandemic created significant challenges for the education of medical students and substantially altered teaching methods for both students and faculty members. The findings of the present study reveal that the effectiveness of online learning in the post-COVID-19 era has been reported to be high among both students and faculty members. Given that online learning infrastructure was established compulsorily during the COVID-19 era and this method of instruction has not been abandoned in the post-COVID-19 era, its blended use with in-person instruction can enhance the quality of education among students and faculty members.

Supplementary Material(s): is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Conflict of interests: There is no conflict of interest.

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References

1. Soleimani A, Asghari F. Benefits and Challenges of Virtual Learning. Research in Experimental Science Education. 2021;1(1):51-61. [In Persian]
2. Hoi SC, Sahoo D, Lu J, Zhao P. Online learning: A comprehensive survey. Neurocomputing. 2021;459:249-89. doi: 10.1016/j.neucom.2021.04.112.
3. Ohanu IB, Chukwuone CA. Constraints to the use of online platform for teaching and learning technical education in developing countries. Education and Information Technologies. 2018;23(6):3029-45. doi: 10.1007/s10639-018-9757-8.
4. Mishra L, Gupta T, Shree A. Online teaching-learning in higher education during lockdown period of COVID-19 pandemic. Int J Educ Res Open. 2020:1:100012. doi: 10.1016/j.ijedro.2020.100012. [PMID: 35059663] [PMCID: PMC7832355]
5. Urokova SB. Advantages and disadvantages of online education. ISJ Theoretical & Applied Science. 2020;9(89):34-7. doi: 10.15863/TAS.2020.09.89.9.
6. Dinmohammadi M, Mohammadi M, Sasani L, Tahrekhani M. Bullying behaviors among medical sciences students in clinical settings: a cross-sectional study. Future of Medical Education Journal. 2024;14(1):9-14. doi: 10.22038/fmej.2023.75383.1566.
7. Purwanto A, Tawar T. Investigating The Role of the use of computer Hardware , software and lecturer involvement on online universities student satisfaction. UJoST-Universal Journal of Science and Technology. 2024;3(1):1-13.
8. Rajabiian M, Saeedi M, Khakshour A, Saeidi K, Alipour-Anbarani M, Jowzi F. Iranian Students' Satisfaction with Virtual Education during the COVID-19 Pandemic: A Systematic Review. Medical Education Bulletin, 2023; 4(1): 611-25. doi: 10.22034/meb.2023.387312.1074.
9. Gheshlagh RG, Ahsan M, Jafari M, Mahmoodi H. Identifying the challenges of online education from the perspective of University of Medical Sciences Students in the COVID-19 pandemic: a Q-methodology-based study. BMC Med Educ. 2022 Dec 27;22(1):895. doi: 10.1186/s12909-022-03980-w. [PMID: 36575524] [PMCID: PMC9793346]
10. Almahasees Z, Mohsen K, Amin MO. Faculty's and Students' Perceptions of Online Learning During COVID-19. Front Educ. 2021;6: 638470. doi: 10.3389/feduc.2021.638470.
11. Abdull Mutalib AA, Md. Akim A, Jaafar MH. A systematic review of health sciences students' online learning during the COVID-19 pandemic. BMC Med Educ. 2022 Jul 3;22(1):524. doi: 10.1186/s12909-022-03579-1. [PMID: 35786374] [PMCID: PMC9251028]
12. Tadesse S, Muluye W. The impact of COVID-19 pandemic on education system in developing countries: a review. OpenJournal of Social Sciences. 2020;8(10):159. doi: 10.4236/jss.2020.810011.
13. Kim S, Jeong SH, Kim HS, Jeong YJ. Academic success of online learning in undergraduate nursing education programs in the COVID-19 pandemic era. J Prof Nurs. 2022 Jan-Feb:38: 6-16. doi: 10.1016/j.profnurs.2021.10.005. [PMID: 35042591] [PMCID: PMC8532369]
14. Alsoufi A, Alsuyihili A, Msherghi A, Elhadi A, Atiyah H, Ashini A, et al. Impact of the COVID-19 pandemic on medical education: Medical students' knowledge, attitudes, and practices regarding electronic learning. PLoS One. 2020 Nov 25;15(11):e0242905. doi: 10.1371/journal.pone.0242905. [PMID: 33237962] [PMCID: PMC7688124]
15. Saiyad S, Virk A, Mahajan R, Singh T. Online teaching in medical training: Establishing good online teaching practices from cumulative experience. Int J Appl Basic Med Res. 2020 Jul-Sep;10(3):149-155. doi: 10.4103/ijabmr.IJABMR_358_20. [PMID: 33088735] [PMCID: PMC7534709]
16. Fallahi-Khoshkenab M. Comparison of virtual education challenges in nursing before and after COVID-19; a systematic review. Iranian Journal of Systematic Review in Medical Sciences. 2023;1(3):81-103. [In Persian]
17. Keshavarzi M, Soltani Arabshahi S, Gharrahee B, Sohrabi Z, Mardanihamooleh M. Exploration of faculty members' perceptions about virtual education challenges in medical sciences: a qualitative study. J Adv Med Educ Prof. 2019 Jan;7(1):27-34. doi: 10.30476/JAMP.2019.41042. [PMID: 30697546] [PMCID: PMC6341450]
18. Rajab MH, Gazal AM, Alkattan K. Challenges to online medical education during the COVID-19 pandemic. Cureus. 2020 Jul 2;12(7):e8966. doi: 10.7759/cureus.8966. [PMID: 32766008] [PMCID: PMC7398724]
19. Yasini A, Taban M. Study of the effectiveness of virtual education courses from the perspective of professors and students (Case study: University of Tehran). Journal of Iranian Higher Education. 2015;7(4):175-200. [In Persian]
20. Kearsley G. Online education: Learning and teaching in cyberspace. 1st Ed. Belmont, CA, US: Wadsworth Thomson Learning; 2000.
21. Smidt A, Balandin S, Sigafoos J, Reed VA. The Kirkpatrick model: A useful tool for evaluating training outcomes. J Intellect Dev Disabil. 2009 Sep;34(3):266-74. doi: 10.1080/13668250903093125. [PMID: 19681007]
22. Schober P, Boer C, Schwarte LA. Correlation coefficients: appropriate use and interpretation. Anesth Analg. 2018 May;126(5): 1763-8. doi: 10.1213/ANE.0000000000002864. [PMID: 29481436]
23. Hameed T, Husain M, Jain SK, Singh CB, Khan S. Online Medical Teaching in COVID-19 Era: Experience and Perception of Undergraduate Students. Maedica (Bucur). 2020 Dec;15(4):440-4. doi: 10.26574/maedica.2020.15.4.440. [PMID: 33603900] [PMCID: PMC7879367]
24. Abbasi Samjdari Z, Jamaledini S, Akavan AM, Borzouee T, Peyman A. The View Point of Faculty Member on The Virtual Education System and the application in the Covid-19 pandemic in Tehran Islamic Azad University of Medical Sciences. Medicine and Spiritual Cultivation. 2021; 30(1): 47-56. [In Persian]
25. Zarei E, Javaheri M, Shikhi A. Identifying effective factors and obstacles using electronic learning to increase mental health of primary school students in Karaj (A qualitative study). Technology of Education Journal (TEJ). 2019;13(3):607-16. doi: 10.22061/jte.2018.3595.1905. [In Persian]
26. Gherheș V, Stoian CE, Fărcașiu MA, Stanici M. E-learning vs. face-to-face learning: Analyzing students' preferences and behaviors. Sustainability. 2021;13(8):4381. doi: 10.3390/su13084381.
27. Almaiah MA, Al-Khasawneh A, Althunibat A. Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. Educ Inf Technol (Dordr). 2020;25(6):5261-5280. doi: 10.1007/s10639-020-10219-y. [PMID: 32837229] [PMCID: PMC7243735]

Table 1. Demographic characteristics of students and faculty members

Demographic Characteristics of Students				
Variable		**Frequency**	**Percentage**	**P-Value**
Gender	Female	158	55.2	0.454*
	Male	128	44.8	
University of study	Zanjan	173	60.5	0.132**
	Shahed	41	14.3	
	Iran	72	25.2	
Field of study	Nursing	207	72.4	0.133**
	Midwifery	32	11.2	
	Operating room	26	9.1	
	Anesthesiology	21	7.3	
Ethnicity	Native	168	58.7	0.449*
	Non-native	118	41.3	
Place of residence	Dormitory	149	52.1	0.654*
	Rented house	20	7.0	
	With family	117	40.9	
Access to virtual learning resources	Poor	20	7.0	0.506**
	Moderate	114	39.9	
	Good	152	53.1	
Family income level	Low	32	11.2	0.068**
	Moderate	238	83.2	
	High	16	5.6	
Demographic Characteristics of Faculty Members				
Gender	Female	42	68.9	0.904**
	Male	19	31.1	
Education level	Master	25	41.0	0.833**
	Doctorate	32	52.4	
	Post-doctorate	4	6.6	
Academic rank	Instructor	27	44.3	0.720**
	Assistant professor	23	37.6	
	Associate professor	9	14.8	
	Professor	2	3.3	
Participation in electronic learning	Yes	48	78.7	0.192*
	No	13	21.3	
Access to virtual learning resources	Poor	11	18.0	0.064**
	Moderate	36	59.0	
	Good	14	23.0	
Experience in virtual teaching	Yes	55	90.2	0.245**
	No	6	9.8	
Membership in the medical staff	Yes	28	45.9	0.024**
	No	33	54.1	
Income status	Low	26	42.6	0.016**
	Moderate	33	54.1	
	High	2	3.3	

*χ^2 test, **Fisher's exact test

Table 2. Frequency distribution of online learning effectiveness from the perspectives of faculty members and students

Online Learning Effectiveness		**Frequency**	**Percentage**
Faculty Member's perspectives	Low	0	0
	Moderate	11	18
	High	44	72.1
	Very high	6	9.8
	Total	61	100

Students' perspectives	Low	2	0.7
	Moderate	122	42.7
	High	155	54.2
	Very high	7	2.4
	Total	286	100

Table 3. The relationship between effectiveness and components of online learning from the perspectives of students and faculty members

Online Learning Components	**Online Learning Effectiveness**	
	From students' perspectives	**From faculty members' perspectives**
	Pearson's correlation coefficient (r)	
Content	0.822	0.641
Teaching-learning activities	0.826	0.867
Page design	0.822	0.624
Educational materials	-0.704	0.548
Feedback	0.776	0.775
Flexibility	-0.656	0.713
Workload	0.832	-0.632
Assistance	0.814	0.762
Motivation	0.706	0.702
Evaluation	0.850	0.748
P-value	< 0.0001	< 0.0001

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Original Article

Usage of High-Fidelity Simulation among Preclinical Medical Students in the Auscultation of Respiratory System

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Abstract

Background: High-fidelity simulation has emerged as an effective educational tool in preclinical medical training, particularly for skills related to the auscultation of the respiratory system.

Objectives: The study aimed to evaluate the impact of simulation on improving auscultation skills in respiratory system examinations among preclinical medical students and to gather views from facilitators and students on the simulation-based teaching and learning process.

Methods: An experimental pre-post study was conducted in a simulation lab of a teaching hospital between March and April 2018 among preclinical MBBS students. A total of 146 students were taken in batches of 50 to the clinical simulation lab. Following exposure to a simulation-based teaching module, they were subjected to post-intervention skill assessments on the high-fidelity simulators. The pre- and post-scores were compared to measure the impact of the teaching module using paired t-tests. The students' perspectives of the current module were compared using the Chi-square test (significance at $p<0.05$) and interpreted with the help of a pre-validated, researcher-made questionnaire.

Results: Pre- and post-intervention scores in the ability to identify breathing sounds (2.05 ± 0.85 and 2.98 ± 0.14) and added sounds (0.40 ± 0.74 and 1.96 ± 0.23) were statistically significant ($p<0.001$).A statistically significant difference in identifying differences in vesicular/bronchial and vesicular breathing and between wheezing and BA/COPD breathing was observed ($p<0.001$).

Conclusion: The medical students perceived high-fidelity simulation-based medical education as a beneficial teaching modality that improved performance. However, more research is required to determine the utility of this modality in a developing country like India.

Keywords: Auscultation; Clinical Competence; High-Fidelity Simulation Training; Medical Education; Respiratory System; Simulation Training

Background

Lung sounds are assessed as part of a standard clinical examination. Despite the advancement of numerous new procedures for detecting lung pathology in recent years, auscultation of the chest remains a useful clinical tool. It is still the most prevalent method for evaluating the lungs. Medical simulation has grown significantly in importance as a tool for clinical evaluation and education over the last 15 years (1).

Preclinical medical students must learn to recognize normal clinical findings during a respiratory system evaluation. The quality and outcome of learning and/or evaluation in simulation events can be improved by accurately reproducing realistic lung and heart sounds (1). Medical simulation has become popular as a valuable tool for both teaching and clinical evaluation (2, 3).

While simulation technology-which includes multimedia computer programs-is relatively new to the

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medical field, other fields have long used it. The use of flight simulators by astronauts and pilots, military personnel in war games and training exercises, business executives in management games, and nuclear power plant personnel in technical operations are a few examples (2). Simulation offers several potential uses at every stage of an individual's professional growth, as well as in assisting professional practice and ongoing professional development (3).

McGaghie et al. (4), in their meta-analysis, found simulation-based medical education with purposeful practice to be better than traditional clinical medical education for meeting specified clinical skill acquisition goals. McKinney et al. (5), in their review, showed that simulation-based medical education was an effective instructional technique for teaching cardiac auscultation. They also proposed that future research should examine key instructional design characteristics and determine the relative effectiveness of simulation-based medical education compared to other educational treatments. Preclinical students could learn about normal clinical respiratory system examinations, such as the auscultation of normal breath sounds from healthy subjects. However, there is a barrier to learning the nuances of abnormal breath sounds, a part of their syllabus during the preclinical phase. Simulation-based instruction becomes critical in their learning curve since the latter cannot be replicated in a healthy individual.

All medical schools aim to equip doctors with the knowledge, abilities, and professionalism required to provide high-quality patient care. Research on medical education aims to improve the efficacy, economy, and efficiency of the enterprise. The immediate and long-term objectives of medical education research are to demonstrate how educational initiatives support the evaluation of physician competency in clinical settings, simulation labs, and classrooms. The ultimate goal of medical education research is improved patient outcomes that are directly linked to educational experiences, which makes this scholarship eligible for translational science designation (4).

Data on the effectiveness of simulation-based learning among students is scarce. In a simulated situation, distinguishing between normal and aberrant breath sounds and identifying irreproducible additional noises in respiratory auscultation becomes easier. The main objective of this study was to assess the impact of simulation on improving auscultation skills in respiratory system examination among preclinical medical students. The findings of this study are anticipated to shed light on the usefulness of simulation-based learning and strategies to improve the module based on input from students and facilitators.

Objectives

The study aimed to evaluate the impact of simulation on improving auscultation skills in respiratory system examinations among preclinical medical students and to gather views from facilitators and students on the simulation-based teaching and learning process.

Methods

An experimental pre-post design study was conducted among 146 preclinical MBBS students admitted to the course during the 2017/2018 academic year in a simulation lab of a teaching hospital and medical institute. Students from both the central board and state board of school education systems were included. Both male and female students aged 18 to 25 were included in the study. Students who did not consent to the research were excluded from the study.

The study was conducted from April 2018 to May 2018 with approval from the Institutional Human Ethical Committee (Proposal no. 18/107; Ref No. PSG/IHEC/2018/Appr/Exp/119). Before the commencement of the study, informed consent was obtained from each participant, and complete anonymity of the participants was ensured throughout the process.

The structured and validated teaching module, comprising a lesson plan, specific learning objectives, learning materials, and an assessment tool (a checklist with scores and an answer key to the questions), was briefed to all facilitators involved, and they were oriented for its execution. The assessment tool was designed based on the guidelines from standard practical manuals (6, 7). Before its use, it was peer-validated with the help of subject experts for content and pretested in a group of first-year medical students who were not included in the main study for reliability (Cronbach's Alpha: 0.741). The students involved in the study had undergone conventional practical small-group teaching classes, using live human subjects to demonstrate breath sounds and added sounds.

Written informed consent from the students was obtained, and the enrolled participants were subjected to a pre-intervention skill assessment using the designed assessment tool. The predesigned learning material, adapted from standard practical textbooks of physiology describing the auscultation of the respiratory system, was provided to them. The students were taken in batches of 50 to the clinical simulation lab. After dividing the students into smaller tutorial groups, the

facilitators implemented the teaching module with deliberate hands-on practice sessions in auscultation and recognizing the unique character of each breath sound and added sounds, namely wheeze, and crepitations, using high-fidelity simulators-SIMMAN 3G and Nursing Anne. Following exposure to the simulation-based teaching module, the study group was subjected to post-intervention skill assessment on the same high-fidelity simulators. Every YES was scored 1, and every NO was scored 0 during the pre- and post-intervention skill assessment.

The pre- and post-intervention scores were compared to measure the impact of the teaching module. The students' and facilitators' perspectives of the current module were interpreted with the help of a feedback questionnaire prepared by the author, which consisted of a set of five close-ended questions with a five-point Likert scale, followed by an open-ended question to welcome additional suggestions to improve the efficacy of the module. This feedback questionnaire was checked for internal reliability (Cronbach's Alpha 0.741). Content validity was done by expert review, and the evidence of acceptability using test-retest reliability was found to be 0.8. The responses to the feedback were categorized into binary variables as favorable and unfavorable to this simulation model and compared with the responses to the conventional model using the Chi-square test.

Data were analyzed using the statistical software R 4.0.3 and Microsoft Excel. Continuous variables were represented by mean ± SD and categorical variables by a frequency table. Shapiro-Wilk's test (Table 1) was used to check the normality of variables. A paired t-test was conducted to compare the two groups. The McNemar test was used to determine if there were differences in a dichotomous dependent variable between two related groups. A p-value less than or equal to 0.05 indicated significance.

Results

The mean ± SD age of the students was 19.8 ± 1.36 years. Among the 146 students, 61.6% (n = 90) were females, and 38.4% (n = 56) were males. Regarding educational background, 61% (n = 89) were from the Central Board of Education, while the remaining 39.04% (n = 57) were from the State Board.

We observed a mean pre-intervention score of 2.05 ± 0.85 in the ability to identify breathing sounds, and the post-intervention score was 2.98 ± 0.14. In addition, a mean pre-intervention score of 0.40 ± 0.74 and a post-intervention score of 1.96 ± 0.23 were recorded to identify added sounds (Table 1).

Using the McNemar test, a statistically significant difference was observed in the ability to identify breath sounds, the difference in vesicular/bronchial breathing, and identifying vesicular breathing ($p<0.001$) pre- and post-intervention (Table 2).

Using the McNemar test, a similar statistically significant difference in the ability to identify added sounds and a difference in identifying wheeze and BA/COPD breathing ($p<0.001$) was observed pre- and post-intervention (Table 3).

Using the paired t-test, we determined that the distribution of ability in the identification of pre- and post-intervention breathing sounds and added sounds is statistically significant ($p<0.001$) (Table 4).

Regarding the feedback from the participants, 79.5% of the students opined that this model made their learning easier, and 78.8% agreed that this technique successfully met the given objectives. Moreover, 82.9% believed this simulation-based learning enhanced their clinical acumen. When the participants' ratings regarding the conventional and simulation-based models were compared, there was a statistically significant difference (Chi-Square Test). The simulation-based model was rated higher ($p<0.001$, Table 5).

Discussion

We conducted a study using a pulmonary auscultation manikin and employed a deliberate practice framework and hypothesis-driven approach to address the demand for teaching lung sounds auscultation. Our study was generally well-received, and it helped us assess the impact of simulation in improving auscultation skills in respiratory system examination among preclinical medical students and gather views on the simulation-based teaching and learning process among facilitators and students.

Typically, simulation is reserved for the clinical years of medical school; however, applying high-fidelity simulation (HFS) to preclinical first-year medical students proved that simulation is a viable method for integrating basic knowledge with clinical scenarios. Our study also observed that the identification of breath sounds, added sounds, and pathological conditions such as bronchial asthma and chronic obstructive pulmonary disease significantly improved in the post-intervention group. HFS is known to replicate clinical scenarios and modify patient cases to help students make informed decisions (8).

Harris et al. assessed first-year medical students' knowledge and perceptions of cardiovascular physiology and congestive heart failure treatment techniques (9). After simulation, comparing a six-question test's pretest and post-test results revealed a 22% improvement in accurate responses. Similarly, Valente et al., in comparing high and low-fidelity simulations for determining respiratory failure in emergency pediatric patients, found that fourth-year medical students usingHFS performed better and had improved confidence in determining variations in clinical conditions and memory retention (10). Nonetheless, students in the intervention group had generally positive opinions toward HFS-based learning, which are similar to those observed in the study by Joseph et al. (11).

The ability of high-fidelity simulation-based medical education (HF-SBME) to improve clinical skills and increase patient safety and comfort was viewed as the most important advantage by the students. According to a study by Joseph et al. (11), over 57.5 percent of students believed SBME would diminish their communication skills. Furthermore, 45 percent of students believed that using SBME would lower their empathy for patients. A study conducted in Malaysia also reported insignificant improvement in knowledge using SBME (12).

This study suggests that SBME is an effective instructional approach for teaching respiratory auscultation. Based on these findings, it can be concluded that nearly all of the students had successfully acquired the auscultation skills of breathing and added sounds. Similar to the present study results, Tawalbeh's study (13) on the influence of simulation on nursing students' cardiopulmonary system examination skills found that the students' skill levels were much greater after the simulation.HF-SBME in an emergency nursing setting also enhanced clinical decision-making skills (14). HFS for cardiac auscultation reduces performance anxiety among students and improves their knowledge, diagnostic capability, and ability to recognize abnormal cardiac sounds (15).

Although a regular feature in the developed world, HF-SBME has only recently gained interest in India (16). Conventionally, these results also showed that the students performed better with simulation-based education, as seen in a study conducted in Karnataka, India, among first-year medical students, which reported enhanced understanding of the clinical scenario, decision-making, communication, and teamwork skills (17).

Money is a major consideration when incorporating HFSB into the medical curriculum in a developing country like India. As a result, careful planning is essential prior to the acquisition and use of such technology.

This research has a few limitations. Since this was a single-center study, the results may not apply to other medical institutes in India. Furthermore, as this study only used SIMMAN 3G and Nursing Anne as simulators, the results may not apply to other simulations. Finally, the examiner's assessment of the student clinical examination was subjective, and more objective assessment techniques could have been used. Multi-center randomized control trials with a greater variety of simulation experiences are required to gain a better understanding.

Conclusion

The observations from the present study reinforce the need for using simulators as a teaching and evaluation tool. In addition, it is thought that implementing simulation applications that include more comprehensive physical examination skills would facilitate the integration of knowledge and skills and improve student attitudes toward holistic patient assessment.

In conclusion, more studies are still necessary to explore the potential use of HFS-based education as an effective tool to increase medical students' competence levels and to better understand its impact on patient outcomes.

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Conflict of interests: There is no conflict of interest.

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References

1. Ward JJ, Wattier BA. Technology for Enhancing Chest Auscultation in Clinical Simulation. Respir Care. 2011 Jun;56(6):834-45. doi: 10.4187/respcare.01072. [PMID: 21333091]
2. Issenberg SB, McGaghie WC, Hart IR, Mayer JW, Felner JM, Petrusa ER, et al. Simulation technology for health care professional skills training and assessment. JAMA. 1999 Sep 1;282(9):861-6. doi: 10.1001/jama.282.9.861. [PMID: 10478693]
3. Bradley P. The history of simulation in medical education and possible future directions. Med Educ. 2006 Mar;40(3):254-62. doi: 10.1111/j.1365-2929.2006.02394.x. [PMID: 16483328]
4. McGaghie WC, Issenberg SB, Cohen ER, Barsuk JH, Wayne DB. Does simulation-based medical education with deliberate practice

yield better results than traditional clinical education? A meta-analytic comparative review of the evidence. Acad Med. 2011 Jun;86(6):706-11. doi: 10.1097/ACM.0b013e318217e119. [PMID: 21512370] [PMCID: PMC3102783]
5. McKinney J, Cook DA, Wood D, Hatala R. Simulation-based training for cardiac auscultation skills: systematic review and meta-analysis. J Gen Intern Med. 2013 Feb;28(2):283-91. doi: 10.1007/s11606-012-2198-y. [PMID: 22968795] [PMCID: PMC3614132]
6. Ghai C. A textbook of practical physiology. New Delhi: Jaypee Bros. Medical; 2013.doi: 10.5005/jp/books/11752.
7. Pal G, Pal P. Textbook of practical physiology. Hyderabad, India: Orient Longman; 2016.
8. Carey JM, Rossler K. The How When Why of High Fidelity Simulation. Treasure Island (FL): StatPearls Pub; 2025. [PMID: 32644739]
9. Harris DM, Ryan K, Rabuck C. Using a high-fidelity patient simulator with first-year medical students to facilitate learning of cardiovascular function curves. Adv Physiol Educ. 2012 Sep;36(3):213-9. doi: 10.1152/advan.00058.2012. [PMID: 22952260]
10. Valente BCHG, Melo MDCB, Liu PMF, Gonçalves BAR, Gomes RADS, Martins IG, et al. High and low-fidelity simulation for respiratory diseases pediatric training: A prospective and randomized study. J Pediatr (Rio J). 2023 Sep-Oct;99(5):521-8. doi: 10.1016/j.jped.2023.04.007. [PMID: 37244290] [PMCID: PMC10492141]
11. Joseph N, Nelliyanil M, Jindal S, Utkarsha U, Abraham A, Alok Y, et al. Perception of simulation-based learning among medical students in South India. Ann Med Health Sci Res. 2015; 5(4): 247-52. doi: 10.4103/2141-9248.160186. [PMID: 26229712] [PMCID: PMC4512116]
12. Pal B, Kumar MV, Soe HHK, Pal S. The efficacy of high-fidelity simulation-based education in enhancing knowledge among undergraduate medical students. Asian Journal of Medicine and Health. 2023;21(5): 23-31.doi: 10.9734/ajmah/2023/v21i5812.
13. Tawalbeh LI. Effect of Simulation on the Confidence of University Nursing Students in Applying Cardiopulmonary Assessment Skills: A Randomized Controlled Trial. J Nurs Res. 2017 Aug;25(4):289-95. doi: 10.1097/JNR.0000000000000170. [PMID: 28683017]
14. Chow KM, Ahmat R, Leung AWY, Chan CWH. Is high-fidelity simulation-based training in emergency nursing effective in enhancing clinical decision-making skills? A mixed methods study. Nurse Educ Pract. 2023 May: 69: 103610. doi: 10.1016/j.nepr.2023.103610. [PMID: 37002992]
15. Patrizio H A, Phyu R, Kim B, Brolis NV. Utilization of Simulation to Teach Cardiac Auscultation: A Systematic Review. Cureus. 2023 Jul 8;15(7):e41567. doi: 10.7759/cureus.41567. [PMID: 37554623] [PMCID: PMC10405975]
16. Martins RS, Sabzwari S, Iqbal M. Effectiveness of Simulation-based Clinical Skills Training for Medical Students in Respiratory Medicine: A Pilot Study. J Coll Physicians Surg Pak. 2021 Dec;31(12):1468-1472. doi: 10.29271/jcpsp.2021.12.1468. [PMID: 34794289]
17. Suvarna P, Basti AR. Use of high-fidelity simulator for teaching cardiovascular physiology principles to the 1st year undergraduate medical students. Indian Journal of Physiology and Pharmacology.2022;66(4):293-8.doi: 10.25259/IJPP_98_2022.

Table 1. Descriptive statistics of the study population

Breath sounds	**Pre-intervention n (%)**	**Post-intervention n (%)**
Vesicular/bronchial		
No	47 (32.19)	2 (1.37)
Yes	99 (67.81)	144 (98.63)
Places diaphragm	19 (13.01)	146(100)
No	127 (86.99)	0 (0)
Yes		
Identifies vesicular		
No	72 (49.32)	1 (0.68)
Yes	74 (50.68)	145 (99.32)
Added sounds		
Identifies wheeze		
No	113 (77.4)	4 (2.74)
Yes	33 (22.6)	142 (97.26)
BA/COPD		
No	121 (82.88)	2 (1.37)
Yes	25 (17.12)	144 (98.63)
Variables	**Mean (SD)**	**Mean (SD)**
Breath sounds total score	2.05 (0.85)	2.98 (0.14)
P-value (Shapiro Wilk's test)	0.16	
Added sounds total score	0.40 (0.74)	1.96 (0.23)
P-value (Shapiro Wilk's test)	0.12	

BA/COPD: Bronchial Asthma/ Chronic Obstructive Pulmonary Disease

Table 2. Comparison of ability in identification of pre and post-intervention of breath sounds

	Post-Intervention No	Post-Intervention Yes	P value
Breath Sound (Vesicular/bronchial)			< 0.001*
Pre-Intervention-No	2	45	
Pre-Intervention-Yes	0	99	
Breath Sound (Places diaphragm)			-
Pre-Intervention-No	0	19	
Pre-Intervention-Yes	0	127	
Breath Sound (Identifies vesicular)			< 0.001*
Pre-Intervention-No	1	71	
Pre-Intervention-Yes	0	74	

*Indicates significance at p<0.05.

Table 3. Comparison of ability in identification of pre and post-intervention of added sounds

	Post-Intervention No	Post-Intervention Yes	P value
Added Sound (Identifies wheeze)			< 0.001*
Pre-Intervention-No	4	109	
Pre-Intervention-Yes	0	33	
Added Sound (BA/COPD)			< 0.001*
Pre-Intervention-No	2	119	
Pre-Intervention-Yes	0	25	

*Indicates significance at p<0.05.
BA/COPD: Bronchial Asthma/ Chronic Obstructive Pulmonary Disease

Table 4. Comparison of ability in the identification of pre- and post-intervention sounds

Variables	Post-Intervention	Post-Intervention	P value
	Mean (SD)		
Breath sound	2.05 (0.85)	2.98 (0.14)	< 0.001*
Added sound	0.40 (0.74)	1.96 (0.23)	< 0.001*

*Indicates significance at p<0.05.

Table 5. Student's feedback on training module

Student's perspective	Favour Simulation model of teaching	Favour Conventional model of teaching	P value
Made their learning easy	116 (79.5%)	30 (20.5%)	< 0.001*
Met the objectives successfully	115 (78.8%)	31 (21.2%)	< 0.001*
Enhanced their clinical acumen	121 (82.9%)	25 (17.1%)	< 0.001*

*Indicates significance at p<0.05.

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Original Article

A Qualitative Study on Hybrid Learning Method in Emergency Department Triage Training During COVID-19 Pandemic

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Abstract

Background: Triage teams in the emergency room face the challenge of quickly and accurately assessing patients with limited information. The triage training program aimed to improve service performance and revitalize the role and function of triage. Continuous training is essential to enhance the decision-making confidence of triage officers, even during the COVID-19 pandemic. However, the pandemic may impact the learning process for training officers.

Objectives: This study explored perceptions of a technical evaluation for triage training and the professionalism of officers responsible for conducting assessments.

Methods: This qualitative study was conducted in the emergency room of a tertiary hospital in March 2022. The study involved 21 participants who received triage training, including five doctors, 11 nurses, and five midwives. Data were collected through semi-structured interviews in Focus Group Discussions to explore perceptions regarding triage training field practices, necessary resources, and the triage system and training evaluation. Interviews were recorded, converted into transcripts, analyzed, and coded until themes and subthemes were developed.

Results: Six themes were identified: personal readiness for training, triage role, triage errors, officer communication, triage performance, and improvements to the triage training system.

Conclusion: This study evaluated the participants' perspectives on pandemic triage training. The findings show a need for regular triage training to enhance the knowledge and skills of triage officers, even in a hybrid setting. This training should be supported by a reliable connectivity and learning system. Evaluating their triage performance is also necessary for accurate patient safety assessments.

Keywords: COVID-19; Training; Triage; Qualitative Study

Background

The emergency department provides unique health services, as it must accept patients with various medical conditions and prioritize them based on clinical urgency. This measure requires fast and precise actions despite unpredictable patient numbers and resource availability (1). Priority for treatment based on medical urgency is evaluated using a triage system (2). Accurate and timely triage decisions are crucial for efficient emergency medical services (3).

Triage teams face the challenge of assessing patients quickly and accurately with limited information (4). Triage decisions rely on officer expertise, and inappropriate decisions can result in treatment delays or worsen a patient's condition, underscoring the need for triage training, in line with a previous study suggesting that a lack of training can be related to inaccurate triaging (5). Continuous training is essential to improve the decision-making confidence of officers (6). Research conducted in Iran revealed that delivering and discussing triage training material increased triage practice scores among nurses (7).

A triage training program was held to improve service performance in the emergency room (ER) and revitalize the role and function of triage. The training was carried out amid the COVID-19 pandemic, which hampered mobility and required an online/in-person hybrid setting. Hybrid learning, a combined approach

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that includes both online and face-to-face instructional methods, was widely adopted during the COVID-19 crisis due to its advantages (8). These include flexibility in terms of time and location, allowing participants to learn at their own pace and according to their learning style, convenient lecture recording, and the freedom for trainers to use a variety of effective training methods such as lectures, group discussions, simulations, and problem-based projects, as well as providing feedback mechanisms (8, 9). In research related to health programs, hybrid learning is as effective as, or more effective than, traditional learning in performance assessment and evaluation (10).

Triage and training materials were delivered online, and the practicum occurred in person while complying with applicable social-distancing rules (11). Self-evaluation continued post-training to obtain training responses through Focus Group Discussions (FGDs). FGDs are useful for collecting data by allowing participants to understand each other's thoughts and experiences to improve the quality of triage services in the ER (12). This study is expected to help evaluate the effectiveness of technical triage training and the professionalism of triage officers in carrying out assessments. The ultimate goal is to improve the future quality of ER triage services.

Objectives

This study explored perceptions of the technical evaluation for triage training and the professionalism of officers responsible for conducting assessments.

Methods

This qualitative study was conducted in a tertiary hospital ER in Jakarta, using FGDs to understand the perceptions of ER medical personnel regarding the hospital triage training that was carried out in November 2021.

Seventy-seven participants, including doctors, nurses, and midwives, took part in triage training at the hospital. The participants were recruited using purposive sampling based on the inclusion and exclusion criteria (Table 1).

Due to the pandemic, a hybrid approach was used for triage training, combining in-person and remote work (10). The training program was accessible online for eight days through the learning management system. It included videos covering triage topics such as the step-by-step process, trauma biomechanics, triage officer roles during resuscitation and transportation, triage therapeutic communication, International Patient Safety Goals application, and infection control.

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Doctors, nurses, and midwives in the emergency department should have at least 3 years of experience, which is relatively early in their careers, especially for professions with specific training pathways like medicine (13).	Hold a managerial position in the hospital.
Have attended prior triage training.	

In-person practicum assignments, including simulations, role-plays, case discussions, and field practice followed the program. Upon completing the training, the participants completed a self-reflection sheet utilizing the six stages of Gibbs' self-reflection cycle: description, feelings, evaluation, analysis, conclusion, and follow-up plan. An expert panel specializing in emergencies reviewed the sheet to select statements for inclusion in FGD exploration. After carefully assessing the participant statements, 21 individuals were selected for the FGD. This group included five doctors, 11 nurses, and five midwives. The general characteristics of the FGD participants are presented in Table 2.

Data were collected in March 2022 by conducting an FGD with three groups (doctors, nurses, and midwives). Before the discussion, the research team, consisting of four emergency specialist doctors, two medical doctors, and two nurses from the emergency department, re-assessed participant self-reflection sheets, prepared questions, and planned the FGD implementation. The discussion process was conducted using a semi-structured interview method, moderated by an emergency specialist doctor, and all participant statements were recorded with their permission and documented by a single note-taker.

During the discussion, participants were asked about their experiences during field practice in triage training, the necessary resources, and their evaluation of both the triage system and training. The discussion for each participant comprised six open-ended questions listed in Table 3. One FGD was conducted per group, lasting 30 minutes to 1 hour (average 44 minutes and 23 seconds). Upon completing the FGD, the session recording was transcribed and carefully reviewed multiple times for a thorough understanding of the interview. Following the interview, the interviewees were also contacted for any clarifications.

Inductive data analysis was conducted using QDA Miner Lite and SPSS Statistics 25. Data analysis and coding were performed and validated by clinicians with more than five years of experience in the emergency field. Additionally, they have been certified as triage-training facilitators. The researchers simultaneously reviewed the FGD transcripts and proceeded with open coding. Each preliminary code was read multiple times and compared to identify and categorize them based on their similarities and differences. Themes were identified, defined, and categorized from the FGD transcripts relating to participant self-reflection on the triage system implementation and training in the hospital ER. To finalize the definition of a theme, the researchers compiled several sub-themes related to the agreed theme and discussed any contentious points to reach a final agreement and consistency.

Results

The FGD involved 21 participants, including five general practitioners, 11 nurses, and five midwives. Qualitative analysis of the FGD transcripts produced six themes: personal readiness for training, triage role, triage errors, officer communication, triage performance, and improvements in the triage training system (Table 4).

Discussion

In this study, we used FGDs to explore the opinions of participants involved in triage training. They provide insights into the skills required for a triage officer to conduct an assessment and evaluate the training they had undergone. When making triage decisions, self-confidence can influence an officer's judgment. According to one study, experienced officers significantly outperformed less experienced ones in triage (14). Another study by Kriengsoontornkij showed that work experience positively correlates with triaging success (15). Sufficient experience in the emergency department can prevent death, disability, and additional healthcare costs.

Self-confidence can be related to the staff's emotional status during patient interaction. Triage nurses require strong psychological capabilities to handle stressful situations. They must remain patient, emotionally stable, and tolerant when treating patients and their families in distress in the ER. Lin et al. found that emergency staff require resilience to effectively use their clinical abilities and act in critical situations (16).

Nurses from the ER and other departments participated in this triage training program. They were eager to establish patient zoning during triage, which could have created an opportunity for team formation among participants who had not previously received triage training.

During the discussion, several officers said they were used to triage assessments and found training and field practice easy. A study by Abbas and Fathoni stated that experience in conducting triage assessments is an important factor for appropriate triaging (17). The study by Madani et al. recommends nurse managers select triage officers by considering the abilities and experience (18). According to the participants, triage is important in the ER as the first stage of hospital services and is crucial for initial management. In the ER, patients with various life-threatening conditions arrive and require immediate treatment. Prioritization is necessary when treating patients based on the severity of their illness (6). Although triage is used as a rapid assessment step in the ER, it can also cause delays in treatment due to a lack of resources, leading to overcrowded conditions, poor outcomes, frustrated patients, and staff fatigue and errors (6). A previous study considered several interventions to overcome long ER waiting times, including minimizing staff turnover, increasing the knowledge and abilities of staff through training, and reducing unnecessary actions such as duplicate patient documentation (7). The triage process requires rapid and accurate decisions; therefore, officers must have sufficient knowledge. Duko et al. emphasized that adequate knowledge of triage and clinical aspects of disease identification and emergency conditions are essential for effective and quality triage assessments (19).

Another study in a Tanzanian hospital found that a lack of knowledge caused assessments errors. Twenty-five percent of patients were placed in lower triage level zones and 42% in higher ones (20). Participants in our study agreed that a lack of in-depth examination during triage assessment causes errors, especially when the triage area is overcrowded and experienced triage officers are needed to quickly gather patients' medical history and perform detailed examinations. This statement aligns with a study that showed inaccurate assessments of patient complaints result from a lack of knowledge and experience in identifying diseases and complaints (21). Health services must address patient safety. Errors in triage assessments must be avoided because they can compromise patient safety (22). Errors can result in under- or over-triaging patients, placing patients at risk, or resulting in unnecessary delays. Triage training should focus on identifying the causes of these errors to minimize negative impacts. Poor collaboration between triage

officers can negatively affect the assessment results. Trust-building and conflict avoidance are crucial in the triage process. According to Welp and Manser, trust and respect among triage officers can improve patient safety and individual satisfaction at work (23). Leadership, self-confidence, and collaboration skills are essential for triage officers dealing with emergencies. Management, leadership, and coordination are crucial in supporting the collaborative abilities of emergency nurses (22). Other studies have also suggested that nurses lacking collaboration skills often struggle to handle situations effectively, particularly in crowded ERs, and tend to become hasty and anxious (11). During our FGDs, participants emphasized the significance of triage officers maintaining a professional appearance, which can instill patient confidence. According to a study by Porr et al., a good appearance can increase patient trust in triage officers (24). Most participants agreed that triage officers and medical staff should receive regular training to keep up with new developments in triage knowledge. One study found that the performance of cancer treatment staff declines after three months and thus ongoing training is needed (25, 26). Another study by Gerard stated that most nurses required regular training, as they forgot or did not practice aspects of their skills (27). Training used a web system to deliver materials and conduct tests. Online learning has been used to limit mobility during the pandemic. The web system for health science training is flexible, easy to access, and suitable for nurses (28, 29). However, connectivity issues are frequently encountered during online training, and it is important to communicate the minimum connection requirements for optimal training.This study showed that triage training can be conducted using a hybrid approach. Hybrid learning is a beneficial educational model, providing more flexibility and resilience than traditional-based instruction. The learning management system is an effective medium for triage training during the COVID-19 pandemic. Even in the post-pandemic era, many people, including health professionals, have become accustomed to the flexibility and convenience of hybrid learning during the pandemic. They may continue to prefer this mode of learning, so hybrid learning will likely continue to play an essential role in training, even after the pandemic has subsided. This study was conducted in a single hospital, which may limit the generalizability of the findings. The small sample size could also affect the ability to detect important effects. Future studies should be conducted with larger sample sizes and at multiple centers with different resources to gain a broader perspective.

Conclusion

Professionalism of the triage officer strongly affects the efficiency and accuracy of triage services. Experience and hard and soft skills reduce mis-triage incidents and increase patient safety. Regular triage training is essential for handling emergency situations effectively. Due to the limited mobility caused by the COVID-19 pandemic, a hybrid training approach was implemented to adapt to the situation and available resources, supported by reliable connectivity and a learning system. Regular triage training should be conducted to evaluate and update triage officers' skills and ultimately support their ability to conduct triage assessments.

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References

1. Australasian College for Emergency Medicine. Guidelines for the implementation of the Australasian Triage Scale in Emergency Department. [cited 2023 Nov 8]. Available from: URL: https://acem.org.au/
2. Qureshi NA. Triage systems: A review of the literature with reference to Saudi Arabia. East Mediterr Health J. 2010 Jun;16(6):690-8. doi: 10.26719/2010.16.6.690. [PMID: 20799600]
3. FitzGerald G, Jelinek GA, Scott D, Gerdtz MF. Emergency department triage revisited. Emerg Med J. 2010 Feb;27(2): 86-92. doi: 10.1136/emj.2009.077081. [PMID: 20156855]
4. Ganley L, Gloster AS. An overview of triage in the emergency department. Nurs Stand. 2011 Nov;26(12):49-56; quiz 58. doi: 10.7748/ns2011.11.26.12.49.c8829. [PMID: 22216667]
5. Considine J, Botti M, Thomas S. Do knowledge and experience have specific roles in triage decision-making? Acad Emerg Med. 2007 Aug;14(8):722-6. doi: 10.1197/j.aem.2007.04.015. [PMID: 17656608]
6. McHugh M. The Consequences of Emergency Department Crowding and Delays for Patients. In: Patient Flow. 2nd ed. Boston: Springer, Boston, MA; 2013: 107–27. doi: 10.1007/978-1-4614-9512-3_5.
7. Kumar A, Lakshminarayanan D, Joshi N, Vaid S, Bhoi S, Deorari A. Triaging the triage: Reducing waiting time to triage in the emergency department at a tertiary care hospital in New Delhi, India. Emerg Med J. 2019 Sep;36(9):558-563. doi: 10.1136/emermed-2019-208577. [PMID: 31366625]
8. Wang X, Liu J, Jia S, Hou C, Jiao R, Yan Y, et al. Hybrid teaching after COVID-19: advantages, challenges and optimization

strategies. BMC Med Educ. 2024 Jul 12;24(1):753. doi: 10.1186/s12909-024-05745-z. [PMID: 38997704] [PMCID: PMC11241882]
9. Padila Nurhasanah D. Opportunities and Challenges of Hybrid Learning: Navigating the Era of Flexible Education. Eastasouth Proceeding of Humanities and Social Sciences (EPHSS). 2023; 1(1):87-98. doi: 10.58812/ephss.v1i01.41.
10. Osaili TM, Ismail LC, ElMehdi HM, Al-Nabulsi AA, Taybeh AO, Saleh ST, et al. Comparison of students' perceptions of online and hybrid learning modalities during the covid-19 pandemic: The case of the University of Sharjah. PLoS One. 2023 Mar 28;18(3):e0283513. doi: 10.1371/journal.pone.0283513. [PMID: 36976823] [PMCID: PMC10047520]
11. Bahrami M, Aliakbari F, Aein F. Team work competence in disaster response: an explorative study about emergency nurses experiences: A qualitative content analysis study. Journal of Clinical Nursing and Midwifery. 2014;2(4):26–36.
12. Krueger RA, Casey MA. Focus groups: A practical guide for applied research. 4th ed. UK: London, England; Thousand Oaks: SAGE Pub; 2009: 63–81.
13. Darlow B, Brown M, McKinlay E, Gray L, Pullon S. Factors Influencing Health Career Choices During Clinicians' First Three Years in Practice. Journal of Research in Interprofessional Practice and Education. 2022; 12(2): 1-13. doi: 10.22230/jripe.2022v12n2a347.
14. Taheri N, Kohan S, Haghdoost AA, Foroogh Ameri G. (dissertation). Assessment of knowledge and activity of nurses in triage field in hospitals of Kerman University of Medical Sciences, 2005. Kerman: Kerman University of Medical Sciences. Kerman, Iran: Kerman University of Medical Sciences; 2006.
15. Kriengsoontornkij W, Homcheon B, Chomchai C, Neamsomboon W. Accuracy of pediatric triage at Siriraj Hospital, Bangkok, Thailand. J Med Assoc Thai. 2010 Oct;93(10):1172-6. [PMID: 20973320]
16. Lin CC, Liang HF, Han CY, Chen LC, Hsieh CL. Professional resilience among nurses working in an overcrowded emergency department in Taiwan. Int Emerg Nurs. 2019 Jan:42:44-50. doi: 10.1016/j.ienj.2018.05.005. [PMID: 29954706]
17. Abbas D, Farahnaz A, Azad R, Morteza G. Factors affecting triage decision-making from the viewpoints of emergency department staff in tabriz hospitals. Iran J Crit care Nurs. 2013;6(4):269–76.
18. Madani F, Saghi M, Fateme J, Leyli EKN, Yazdanipour MA. Factors associated with hospital Triage decision making from the viewpoints of emergency nurses. Journal of Advanced Pharmacy Education and Research. 2019;9(S2):169-75.
19. Duko B, Geja E, Oltaye Z, Belayneh F, Kedir A, Gebire M. Triage knowledge and skills among nurses in emergency units of Specialized Hospital in Hawassa, Ethiopia: Cross sectional study. BMC Res Notes. 2019 Jan 14; 12(1): 21. doi: 10.1186/s13104-019-4062-1. [PMID: 30642384] [PMCID: PMC6332676]
20. Aloyce R, Leshabari S, Brysiewicz P. Assessment of knowledge and skills of triage amongst nurses working in the emergency centres in Dar es Salaam, Tanzania. African Journal of Emergency Medicine. 2014;4(1):14–8. doi: 10.1016/j.afjem.2013.04.009.
21. Gerdtz MF, Bucknall TK. Triage nurses' clinical decision making. An observational study of urgency assessment. J Adv Nurs. 2001 Aug; 35(4): 550-61. doi: 10.1046/j.1365-2648.2001.01871.x. [PMID: 11529955]
22. Grover E, Porter JE, Morphet J. An exploration of emergency nurses' perceptions, attitudes and experience of teamwork in the emergency department. Australas Emerg Nurs J. 2017 May;20(2):92-97. doi: 10.1016/j.aenj.2017.01.003. [PMID: 28196705]
23. Welp A, Manser T. Integrating teamwork, clinician occupational well-being and patient safety - Development of a conceptual framework based on a systematic review. BMC Health Serv Res. 2016 Jul 19:16:281. doi: 10.1186/s12913-016-1535-y. [PMID: 27430287] [PMCID: PMC4950091]
24. Porr C, Dawe D, Lewis N, Meadus RJ, Snow N, Didham P. Patient perception of contemporary nurse attire: A pilot study. Int J Nurs Pract. 2014 Apr;20(2):149-155. doi: 10.1111/ijn.12160. [PMID: 24713011]
25. Corner J, Wilson-Barnett J. The newly registered nurse and the cancer patient: An educational evaluation. Int J Nurs Stud. 1992 May;29(2):177-90. doi: 10.1016/0020-7489(92)90007-4. [PMID: 1612836]
26. Day T, Wainwright SP, Wilson-Barnett J. An evaluation of a teaching intervention to improve the practice of endotracheal suctioning in intensive care units. J Clin Nurs. 2001 Sep;10(5):682-96. doi: 10.1046/j.1365-2702.2001.00519.x. [PMID: 11822519]
27. Gould D, Chamberlain A. Infection control as a topic for ward-based nursing education. J Adv Nurs. 1994 Aug;20(2):275-82. doi: 10.1046/j.1365-2648.1994.20020275.x. [PMID: 7930145]
28. Nadeau MC, Bilodeau K, Daoust L. Using web-based training to optimize pediatric palliative care knowledge transfer. Can Oncol Nurs J. 2020 Jan 1;30(1):31-7. doi: 10.5737/236880763013137. [PMID: 33118985] [PMCID: PMC7585705]
29. Arenella C, Yox S, Eckstein DS, Ousley A. Expanding the reach of a cancer palliative care curriculum through web-based dissemination: A public-private collaboration. J Cancer Educ. 2010 Sep;25(3):418-21. doi: 10.1007/s13187-010-0066-1. [PMID: 20237885]

Table 2. Characteristics of FGD Participants

Code	Participants	Education History	Work experience (years)	Gender
D1	Doctor	Masters	5	Man
D2	Doctor	Bachelor	4	Woman
D3	Doctor	Bachelor	3	Man
D4	Doctor	Bachelor	4	Man
D5	Doctor	Bachelor	1	Woman
N1	Nurse	Diploma	16	Man
N2	Nurse	Bachelor	9	Man
N3	Nurse	Bachelor	8	Man
N4	Nurse	Diploma	13	Man
N5	Nurse	Bachelor	16	Woman

N6	Nurse	Diploma	4	Woman
N7	Nurse	Diploma	10	Man
N8	Nurse	Bachelor	16	Man
N9	Nurse	Bachelor	11	Man
N10	Nurse	Bachelor	5	Woman
N11	Nurse	Bachelor	11	Woman
M1	Midwife	Bachelor	10	Woman
M2	Midwife	Bachelor	15	Woman
M3	Midwife	Bachelor	11	Woman
M4	Midwife	Bachelor	16	Woman
M5	Midwife	Bachelor	11	Woman

Table 3. FGD Questions

Questions
How do you react or feel when carrying out triage management while on duty in the field?
In your opinion, what is the role of triage in the ED, and why?
Do you over-triage or under-triage when carrying out field duties? If it happens, what do you think is the cause?
What is the role of team communication in triaging patients?
In your opinion, what skills are needed for triage officers to carry out appropriate treatment? What currently needs to be improved?
Is regular triage training necessary? How often should it be conducted, and is it required for everyone? In your opinion, what can be done to improve the quality of triage training?

Table 4. Themes and Subthemes

Themes and subthemes	**Sample comments**	**Number of referrals***
	Emotional reactions when attending training (participant)	
Lack of self-confidence	"I felt more awkward because I had never served in the triage department, especially outside the obstetrics department." (M4) "I was nervous because it was my first time practicing triage, and I felt like I had given the wrong zone categories" (N11)	8 (7)
Enthusiasm	"I have never experienced triage before, since it was my first experience, it was enthusiastic and thrilling." (N10) "When on duty at triage, we are better trained to differentiate between urgent and non-urgent patients, which makes us happy and satisfied when taking action." (M3)	6 (6)
Daily habits	"Since I have been in triage for a long time, so I am used to it, it's just that yesterday there were some theories presented, especially the principles of triage. So far I haven't done it because usually when a patient comes, we immediately do an anamnesis of the patient's complaints, without introducing ourselves and so on." (D1) "I've been on triage duty many times. It's just that because I was supervised during training, it was a bit tense, but after that, it was normal." (N6)	9 (9)
	Triage role	
Patient sorting	"It's very important because triage makes it easier to divide patients, for example, if there are patients with certain criteria, we can find out the waiting time for patient treatment." (D5) "The role of triage makes it easier for us to sort patients, for example, whether the patient is in urgent or non-urgent category." (M4)	11 (11)
Resources Availability	"Carrying out triage is crucial to ensure that the limited number of facilities in the ER are not overwhelmed by too many patients." (N2)	1 (1)
Triage as the initial entry to the ER	"It's very important, because triage is the first entry point for a patient to come to the ER, if the patient doesn't make an impression at triage, usually there will be problems later." (D1) "The role of triage is very important, because triage is the front line, to select and sort patients into emergency and non-emergency categories." (N3)	8 (8)

Errors in triage		
Lack of experience	"Knowledge and experience; because we will determine based on what we know, if we have both, we will be able to triage correctly because all we have to do is complete the triage format, ask for complaints briefly, and most importantly the discriminator." (D4) "Lack of knowledge or experience of officers can lead to cases of under-triage orover-triage…" (M5)	3 (3)
Lack of in-depth examination	"This could be due to rushing to evaluate the patient's condition and can't gather a detailed history." (M4) "Mistakes such as over triage, usually because we see it directly in a hurry because the patient is panicking and have not examined it properly, also because of lack of knowledge, or under triage errors because the patient looks calm, but it turns out we are lacking in the examination. So our accuracy and ability in the examination are very influential." (N5)	15 (15)
Unwanted event	"A fatal condition that may arise is the possibility of the patient passing away." (M4) "…. patient was placed in the yellow zone, but then the patient had to be moved to the red zone because he was restless and his consciousness suddenly decreased..." (M3)	3 (2)
Overcrowded emergency room	"Usually when there are a lot of patients, the process just speeds up." (N2) "Under triage or over triage errors can occur due to overcrowded patients, and triage teams that sometimes do not focus enough on the patient's clinical situation also play a role." (N9)	2 (2)
Communication between officers		
Preventing delays	"Communicating with fellow triage officers means helping each other, such as educating patients whose conditions are not classified as an emergency to go to the polyclinic, so that we can provide quick treatment for truly emergency cases." (N2)	1 (1)
Patient safety	"...Because if there is miscommunication, it will have an impact on patient safety." (N1) "Regarding communication, this is very important, because our impression when receiving a patient at triage will affect the patient's condition later when they are inside to receive treatment based on the disease and its severity." (N10)	2 (2)
Communication and Collaboration	"For teamwork, it is very important, especially for collaboration, there are those who have and don't have experience, so cooperation and collaboration are very important in a team." (M3) "Communication is very important and needs to be improved along with cooperation, use it to complement each other, know each other's strengths." (D3)	15 (15)
Triage performance		
Knowledge	"Basic principles are knowledge, communication, emotional matters, attitude, courage and self-confidence, and if anyone is in doubt, have a short discussion to get more focused." (D4) "Through our knowledge and critical thinking, we can find out what disease the patient is suffering from and we can determine whether immediate treatment is needed or not." (N11)	19 (17)
Communication skills	"Good communication, so patient acceptance will be good. Because if communication is bad then conflicts with the patient's family will often occur. …" (D1) "The most important thing is knowledge and communication skills to deal with patients and their families. If our knowledge is lacking in diagnosing and seeing the patient's prognosis, under triage can occur." (M3)	15 (15)
Emotional skills	"Emotional management skills, complaint management, how to deal with certain situations, how not to get carried away by emotions when the patient is angry." (M2) "Anger management, because it's very stressful in the triage, when we face a panicked family, we have to maintain calm, if we are not calm it will affect our triage process." (N7)	12 (11)
Self-confidence and Leadership	"Apart from communication, leadership skills, confidence, and attitude are needed, because in triage you don't have to stand alone, there are also nurses and security, so leadership ability is important to manage the conditions there." (D3) "Even though we have the knowledge and certification, if we still feel nervous, anxious during practice, and lack confidence, this can affect triage performance." (M5)	12 (7)
Physical appearance	"... If the patient and their family perceive our appearance to be in good condition, they will feel more confident that we are providing the best and most appropriate service." (N9)	1 (1)
Improved triage training system		
Offline training	"I had face-to-face training before, yesterday was online. After comparing, it is better offline, so when we are given material, during the question and answer session, we can ask questions and they will be answered at that time." (N6)	7 (7)

	"In my opinion, training is better done offline because we can understand the training better, if we only watch videos we can only imagine. However, if there is still a pandemic, it is better to add a little more time to the face-to-face training session." (M4)	
Training management	"...It also includes material from various departments, such as pediatrics, obstetrics, psychiatry, and their emergency services." (N7) "...In practice, perhaps the facilities could be improved, for example, yesterday we carried out triage but there was no triage form. In the future, we must be better prepared." (N1)	40 (20)
Web-based system optimization	"...but at that time there were a few crashes in the online section, sometimes the server went down, so sometimes when we worked on it, the post-test didn't saved." (D5)	1 (1)

*The first number shows the number of mentions of the theme or subtheme when participants commented; the number in parentheses shows the number of participants who mentioned the theme or subtheme (participants could mention the same theme or subtheme several times).

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Original Article

How Did the COVID-19 Pandemic Affect the Clinical Skills and Competencies Among New General Physicians: A Qualitative Study

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Abstract

Background: Amidst the COVID-19 crisis, many new general physicians who were medical interns during the pandemic were deprived of clinical rotations, new learning situations, and educational opportunities. This situation has resulted in a lack of confidence in graduates for fulfilling their duties as physicians.

Objectives: This study was designed to investigate the clinical education challenges of New General Physicians who were medical interns (Sixth and Seventh-year medical students) during the COVID-19 pandemic.

Methods: This qualitative conventional content analysis study was conducted from November 2022 to February 2023in Iran. Data were collected using semi-structured in-depth interviews to understand the educational challenges of medical graduates during covid-19 pandemic. Seventeen purposefully retrieved and participated in the study. After data saturation, analysis was performed using Graneheim and Lundman's approach (2004).

Results: The data analysis from interview coding led to the extraction of two main categories: Ineffective Clinical Education and Inadequate Outcome, with seven subcategories including Poor management clinical education planning, clinical resource restriction, online learning pitfalls, skills, attitude and knowledge needs, and deficiency in professional interactions.

Conclusion: The results showed that the crisis caused by the COVID-19 pandemic had a serious impact on achieving the desired competence of new general physicians who completed part of their clinical training during that period. Therefore, attention and planning through continuing medical education (CME) is essential.

Keywords: Clinical; Skills; Clinical Competency; COVID-19; New General Physicians

Background

The emergence of the COVID-19 pandemic has created significant challenges in the world (1). This pandemic had a profound impact not only on the health and treatment systems but also on higher education and teaching (2-4). Different countries had different responses to the COVID-19 pandemic, ranging from complete university lockdowns to the early graduation and employment of students as staff (5). The Association of American Medical Colleges recommended in March 2020 the "immediate suspension of medical students' involvement in any activities that involve patient contact." because medical students are not only at risk but also can potentially serve as carriers due to their repeated rotations and contact with healthcare staff and patients (6). This interruption in clinical education could result in a lack of competency in graduate students (7). In Iran, like other countries, changes were made in the education of medical students, especially final-year medical students, such as the suspension of clinical rotation in the clinical internship period or a significant reduction in the hour's students attend the hospital (2, 8). These changes will definitely have consequences. A study conducted by Choi et al. in 2020 showed that the

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impact of COVID-19 on the education of senior-year medical students in Britain has been significant. Most students were unprepared to begin working as physicians. The results of this study showed that educational disruptions during the last two years of the study significantly affected their preparedness (5). Ferrel et al. (2020) also suggested that the cancellation of internships, which are essential both for acquiring skills and establishing relationships, is a serious issue faced by students and medical faculties. Many medical students have lost the opportunity for personal growth through conference presentations, which could inflict serious damage on their career paths (9). During the SARS outbreak in 2004, 60% of residents believed that the cancellation of educational activities or fundamental clinical rotations put their education at risk (10). Kumar and colleagues (2022) revealed that all stakeholders are concerned about attaining credentials by medical students amidst the COVID-19 pandemic and the subsequent impact on future Indian Medical Graduates (IMG). This study also highlights the deprivation experienced by medical students during the health crisis, wherein they were not only restricted from gaining clinical experience but also from engaging in social interactions within genuine clinical environments utilizing the learner-physician clinical education approach (11). Therefore, identifying and considering opportunities to improve the experience and performance of medical students as future physicians is essential.

Objectives

The purpose of this study was to understand the clinical education challenges of new general physicians who were medical interns (Sixth and Seventh-year medical students) during the COVID-19 pandemic.

Methods

Study design: The current qualitative study was conducted using the conventional content analysis approach to identify the clinical education challenges of new general physicians who were medical interns during the COVID-19 pandemic.

Setting: This study was conducted from November 2022 to February 2023 at the hospital and health care center of Bushehr University of Medical Sciences.

Selection of Participants: New general physicians who were medical interns during the COVID-19 pandemic at Bushehr University of Medical Sciences.

Participant inclusion criteria: All General physicians who were medical interns during the COVID-19 pandemic. For all participants the following criteria were met: willingness to participate in the study, having Iranian nationality, and being able to communicate and share their experiences.

Data collection procedure: In this study, we used purposeful sampling with Maximum variation based on essential demographic information and work environments such as age, gender, marital status, and workplace. Data saturation occurred after interview 12 and was continued for up to 5 more people to be sure (12).

Semi-structured and in-depth interviews were used to collect data. To ensure the participant's comfort, their preferences for the time, location, and format of the interviews, (in person or by phone) were considered. The duration of the interviews ranged from 40 to 90 minutes. Interviews were conducted by the first author (BB) from November 2022 to February 2023.

All interviews were recorded using a voice recorder and transcribed verbatim by the researcher immediately after the interviews. The main questions revolved around the educational, knowledge-based, skill-based, and attitudinal needs of the graduating new general physicians during the COVID-19 pandemic. The interviews began with a general question about the impact of COVID-19 on their education and ended with more specific questions. For example: "What was your experience with education in various clinical areas during the COVID-19 pandemic? Did you encounter any challenges in your work environment after graduation that could be attributed to clinical education during the COVID-19 pandemic? To further deepen the findings, probing questions were used**.** Three interviews were ambiguous, so an additional interview was conducted with them.

After explaining the purpose and methods of the research, permission to record the conversation, and written informed consent were obtained from all participants. Confidentiality was maintained throughout all stages of the study, using codes to refer to participants when reporting findings (Participant: P1, P2, P3, etc.). Additionally, participants were assured that they could withdraw from the study at any time.

Data analysis: The data analysis was conducted using a conventional content analysis approach, following the method of Graneheim and Lundman (13). At the end of each interview, the recorded audio files were meticulously transcribed word by word. The written text

was studied several times to obtain a general sense of it. Ambiguous items were clarified by recontacting the participants and their explanations were added to the transcriptions. For initial coding, meaningful units from the participants' statements in the form of initial or open codes were extracted from the interviews. The codes were then compared in terms of their conceptual similarities and differences. Similar codes were grouped into categories, and these categories were subsequently combined to form broader categories. By comparing these categories engaging in careful and deep reflection, and synthesizing these categories extracted principal themes. The coding was done manually (Table 1).

Trustworthiness: The Lincoln and Guba criteria were used to ensure the rigor of the data (14). The credibility aspect was achieved through prolonged engagement with the study's subject to ensure an in-depth understanding of the concept and immersion in the data. To increase the confirmability criterion, the initial coding of data (conducted by the first author) was independently reviewed by each research team member, followed by a collective review by all research members. Additionally, two colleagues familiar with the qualitative analysis method who were not part of the research team assessed coded data for the study process**.** Furthermore, maximum sampling variation increased the data's confirmability and credibility. Finally, a non-participating new general physician, reviewed the results to ensure their accuracy, completeness, and consistency of the interpretations with the participant's experiences as well as to confirm correct coding. To achieve the transferability stages of the study, decisions made throughout the process were carefully recorded and reported. Also, during the interview, the researcher followed the principles of open and in-depth interviewing and bracketing.

Decisions made during the process.

Ethical approval: Permission to conduct the present study was obtained from the Ethics Committee of Bushehr University of Medical Sciences (IR.BPUMS.REC.1401.174). Necessary information about the research goals was provided to the participants, and while assuring them of the confidentiality of the collected information, their permission to record the interviews was obtained. Informed consent forms were also obtained from all the participants, and they were reassured that withdrawal from the study would not have any negative consequences for them.

Results

The study involved 17 new general physicians, aged between 25 to 28 years, with a minimum of one month of work experience. The demographic characteristics of the participants are shown in Table 2.

In the process of data analysis, 340 initial codes were extracted.

These codes were categorized into seven subcategories, ultimately resulting in two main categories, Ineffective Clinical Education and Inadequate Outcome (Table 3).

Main Category 1: Ineffective clinical education

Clinical education is crucial in preparing and facilitating the successful transition of medical students into the actual healthcare setting**.** The COVID-19 pandemic presented a significant challenge to clinical training as clinical rotations were suspended and the patient population in hospitals decreased. One of the main categories mentioned by the new general physician was the inadequacy of clinical education, which includes subcategories, poor management of clinical education planning, clinical resource restriction, and online learning pitfalls.

Poor management of clinical education planning: Due to the COVID-19 pandemic and its sudden waves, clinical rotations were suspended or reduction of clinical rotations for an extensive period, causing distressing impacts. In addition, due to the heavy involvement of professors in the COVID-19 pandemic, clinic training (teaching rounds, morning reports, and outpatient training) was canceled without an alternative program.

In this regard, one of the participants said "*Clinical rotation training was suspended at the beginning of each wave of the pandemic, which seemed illogical* (Participant12).

Another participant, a female general physician with 4 months of work experience said:" *We typically received training in the hospital clinic. However, when the clinic was suspended, sometimes the professor allowed us to observe patients alongside him/her in the office. It was very beneficial"* (Participant 2).

Clinical resource restriction: Hospital equipment in the hospital is designed to maintain the health of patients and medical staff. During the COVID-19 pandemic, masks and gloves were provided to students to protect their health, but it was not sufficient. Due to reduced clinical rotation times, they couldn't use the resort. In addition, the decrease in the number of hospitalized patients and equipment had an impact on clinical education.

"*Because we didn't have new masks and gowns, we couldn't take off the masks and gowns, so we couldn't even eat lunch*." (Participant 9).

Another participant, a new general physician who worked in the general hospital in this regard stated: "*Because most of the patients in the only general teaching hospital were patients with COVID-19, we were on treating COVID-19 patients. Consequently, there were no various cases of other illnesses.*" (Participant 6).

Online learning pitfalls: While virtual education played a crucial role in addressing the educational void during the COVID-19 pandemic by organizing conferences and morning reports it faced significant challenges, especially in countries like Iran and smaller universities. These challenges included concerns about content effectiveness, unconventional use in clinical courses, limited familiarity with new platforms, decreased internet speed, low-quality files, and inadequate infrastructure.

"*Because we could not see the instructor, we could not focus properly in virtual classes, and the internet speed was so low that it kept disconnecting so that I kept falling asleep*" (Participant 11).

The other male participant stated:" *The professor's voice on the slides was so weak that I raised the volume to the end, but I still didn't hear her*" (Participant 9).

Main Category 2: Inadequate Outcome

The shortcomings of clinical education and the inability and unpreparedness of the student to function as an independent physician were identified as the main category related to the consequences of clinical education's inadequate outcome, which consisted of four subcategories: skill needs, knowledge needs, attitudinal needs, and deficiencies in professional interactions.

Skill Needs: Achieving clinical competency and essential skills is a necessary condition for a physician to perform independently in a real environment. Shortening or suspension of clinical rotations and allocating clinical departments to COVID-19 patients during the COVID-19 crisis had hindered interns from gaining the necessary skills.

"*I really do not have confidence in patient management and am constantly afraid of making a wrong diagnosis*" (Participant 4).

"*I had a patient with a pea stuck in his nose and I did not know what to do because, for my emergency stint, which was very important, I had only seen COVID-19 patients*" (Participant 2).

Attitudinal Needs: Attitude reflects thoughts and feelings about a person, object, or subject that can be evaluated in his cognitive, emotional, and behavioral information. If medical students do not have hope of fulfilling their desires in their field of study, in that case, their motivation for learning and effective teaching will be impaired, which will affect their responsibility and efficiency in the future. In addition to educational adverse outcomes, the coronavirus pandemic also had significant psychological effects on graduates. Concerns about learning and future careers were evident in the interviews and dissatisfaction with the education was often mentioned. In this regard, one of the participants stated:

"*I feel like we were exploited as a workforce*" (Participant 6).

Another participant said: "*I felt unjustly treated in my education*" (Participant 3).

Another male doctor participant described his experience: "*I felt, I had no self-confidence as a new physician to manage patients*" (Participant 9).

"*The…. Hospital was the only general teaching hospital at the provincial level and the decision to allocate this hospital to the COVID-19 section had irreversible outcomes for clinical education.*" (Participant 7).

A male doctor with 8 months of experience in the emergency department described his experience of workload and stated:

"They *were forced to use interns and even clerkships as auxiliary forces. They had no other choice; there was a shortage of staff*" (Participant 15).

Cognitive Needs: Clinical knowledge complements theoretical knowledge, and to use theoretical knowledge, students need clinical experience. However, with the COVID-19 crisis and lack of proper planning, this did not happen, and the opportunity to see patients and various cases did not exist for students. As a result, students were unable to apply their theoretical knowledge in the clinical training.

"*We saw very few patients, so much so that all the cases were new during the "TAHR" (Obligation to serve in government hospitals after free education), and it was difficult for me to make any diagnosis*" (Participant 10).

"*When a patient comes, I get confused between differential diagnoses and I do not know how to act because I did not see patients during my internship period. I don't know how to use my theoretical knowledge*"(Participant 9).

Deficiency in Professional Interactions: Establishing effective communication with patients and their companions is crucial to building trust and can be considered the heart of medicine. New general

physicians could learn to communicate effectively with their colleagues, patients, and companions. However, according to them, social distancing and lack of interaction with the patient prevented this. As a result, they did not feel prepared to communicate with patients and answer common questions.

"*We really did not learn to communicate with patients and their companions. For example, a patient said he takes green pills; and I do not know what pills he means; and I do not know what the right response may be. Well…., they do not trust me*" (Participant 3).

A male and recent physician described his experience of social distance and lack of communication skills and mentioned:

"The need to observe social distance and the fear of contracting the coronavirus reduced face-to-face contact with us" (Participant 6).

Discussion

This study was conducted to investigate the educational challenges of medical graduates during the COVID-19 pandemic. The results suggested that two categories of factors Ineffective clinical education, and - Inadequate Outcome played a role in shaping the educational challenges of learners. This ultimately led them to have a different understanding of their capabilities as medical graduates. Graduates must possess the ability to apply scientific and practical knowledge and clinical skills. However, the coronavirus pandemic created challenges for medical education and the establishment of necessary competencies in medical students (5, 9). New general physicians who were medical interns during the COVID-19 pandemic had varied feelings about that.

The first finding, related to ineffective clinical education, indicated that the need to preserve the health of students forced medical educators to adopt and utilize technology and e-learning-based education In this study, the main challenges of online education faced by new general physicians were the use of content, content quality, downloads, fatigue, sleepy, and students' lack of focus due to instructors' not using webcams because of low internet speed, and hence not seeing the instructor. The participants highlighted that slow internet speed, inadequate infrastructure, and insufficient software were significant challenges in online education. The study conducted by Albalas et al (2020), Hayat et al (2021), Maatuk et al (2022), and Yazdani et al (2017) mentioned the lack of infrastructure, technology, internet access, and poor quality of internet services as barriers affecting both students and faculty members (15-18). However, at the same time, confusion and weakness in crisis management sometimes lead to unexpected and unplanned decision-making. Allocating the sole general educational hospital as a center for patients with COVID-19 and suspending training rotations with every peak of the COVID-19 pandemic were among these decisions that reduced the number and variety of cases and irreparable damage to clinical education. This led to a decrease in clinical skills as well as professional growth and essential competencies of graduates, which in turn led to anxiety and a lack of confidence in their professional performance. The Association of American Medical Colleges and most medical universities also decided to suspend clinical rotation with the first wave of the COVID-19 pandemic (19, 20). The study conducted by Franklin et al (2021) stated that more than half of the students stated that their specialties surgery, internal medicine, and obstetrics and gynecology, and their sub-specialties were affected by the temporary quarantine due to the COVID-19 pandemic (21).

The second finding, regarding the failure to gain necessary knowledge, skills, attitudes, and deficiencies in professional interactions, were consequences of deficient education, causing students' concern for their future careers. This seemed to take away the students' confidence needed for patient management, communication with the patient, and making proper diagnoses. In a study by Harries (2021), most students agreed that the pandemic has significantly disrupted their education and believed that regular clinical rotations should continue throughout the pandemic, with 83.4% agreeing to return to clinical rotations (20). Also, Hoernke et al (2020) demonstrated that engagement with actual patients is an inseparable part of becoming a physician. Medical students expressed dissatisfaction due to the lack of clinical training and interaction with patients (22). Dhillon et al (2020) demonstrated that the COVID-19 pandemic led to a notable decline in the acquisition of clinical skills, posing a considerable challenge to Canadian medical clinical training (23).

Tan et al (2023) illustrated the impact of the COVID-19 pandemic on clinical examinations, highlighting that simulated patients are incapable of completely substituting the invaluable experience and engagement that medical students derive from authentic patient interactions (24). Harries et al (2021), stated that the COVID-19 pandemic disrupted the United States

medical education system with the unprecedented and essential national recommendation by AAMC to halt all clinical rotations of students with in-person patient care (20). Additionally, Saoji et al (2022) indicated that all ongoing internship programs, clinical rotations of final-year medical students and interns were suspended with a focus on preventing the spread of the disease (25). The impact of the COVID-19 pandemic on clinical medical education was significant in the worldwide (26-28). As a result, the participants in this study felt less confident in their abilities as general practitioners.

Negative feelings, attitudes, and dissatisfaction with non-teaching duties during the internship period were among the issues mentioned by the new physicians. Kaul et al (2021), indicated that in the face of an unprecedented shortage of qualified healthcare workers, several reliable alternatives for workforce expansion were considered, including the deployment of competent and willing medical students by institutions (29). Some institutions were forced to limit the number of team members entering patient rooms and conducting physical examinations each day to reduce the risk of transmission to healthcare workers. Fear of contracting the disease, concerns for their families, and the need for social distancing were among the barriers to acquiring physical examination skills, history taking, and other clinical skills frequently mentioned by the participants (20, 27, 30).

Deficiencies in professional interactions and the inability to establish proper communication with patients, their companions, and colleagues were also among the consequences of suspending and reducing clinical rotations and the necessity of maintaining social distance, as pointed out by the participants. Numerous texts emphasized the role and impact of proper physician-patient communication in many medical matters, including prevention, treatment, care, and treatment participation. Poor physician-patient communication can not only result in patient noncompliance with treatment but also lead to the patient being more likely to change their doctor and healthcare system (31-33).

Limitations: Given that this study was conducted at Bushehr University of Medical Sciences and due to the nature of the study and the limited number of participants, it may not be generalizable to other universities.

Additionally, some of the interviews were conducted over the phone due to the comfort of the participants

Conclusion

The COVID-19 pandemic significantly challenged medical education. The rapid shift to electronic education partially addressed the cognitive needs of medical students. However, the suspension and reduction of clinical rotations, along with the reassignment of clinical departments to COVID-19 care impacted both supervised learning and direct supervision observation. This led to a decline in clinical, cognitive, and attitudinal skills, as well as professional growth and essential competencies. As a result, many students experienced anxiety and a lack of confidence in their professional abilities. Identifying the educational challenges during a pandemic and providing appropriate solutions, such as continuing education programs for new general physicians and effective strategies for students during future crises, can significantly benefit policymakers and healthcare providers in future crises.

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Conflict of interests: There is no conflict of interest.

Ethical approval: Ethics approval and consent to participate Permission to carry out the present study was obtained from the Ethics Committee of Bushehr University of Medical Sciences (IR.BPUMS.REC.1401.174). When participants were provided with information about the objectives of the research and asked to give their permission to make audio recordings of the interviews, they were assured that the information gathered would remain confidential. Written informed consent was obtained from all the participants, and they were informed that they could leave the study whenever they wished. Also, all methods were carried out according to relevant guidelines and regulations.

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References

1. Sahi PK, Mishra D, Singh T. Medical education amid the COVID-19 pandemic. Indian Pediatr. 2020 Jul 15;57(7):652-7. doi: 10.1007/s13312-020-1894-7. [PMID: 32412913] [PMCID: PMC7387262]
2. Taghizadeh S, Haji J, Mohammadimehr M. A Comparative Study of the Challenges and Opportunities of Higher Education in the Corona Pandemic in Iran and around the World. Nurse and Physician Within War. 2020; 8(27): 47-57. doi: 10.29252/npwjm.8.27.47.
3. Newman NA, Lattouf OM. Coalition for medical education-A call to action: A proposition to adapt clinical medical education to meet the needs of students and other healthcare learners during COVID-19. J Card Surg. 2020 Jun;35(6):1174-1175. doi: 10.1111/jocs.14590. [PMID: 32353907] [PMCID: PMC7267341]
4. Mian A, Khan S. Medical education during pandemics: A UK perspective. BMC Med. 2020 Apr 9;18(1):100. doi: 10.1186/s12916-020-01577-y. [PMID: 32268900] [PMCID: PMC7141929]
5. Choi B, Jegatheeswaran L, Minocha A, Alhilani M, Nakhoul M, Mutengesa E. The impact of the COVID-19 pandemic on final year medical students in the United Kingdom: a national survey. BMC Med Educ. 2020 Jun 29;20(1):206. doi: 10.1186/s12909-020-02117-1. [PMID: 32600460] [PMCID: PMC7323883]
6. Sani I, Hamza Y, Chedid Y, Amalendran J, Hamza N. Understanding the consequence of COVID-19 on undergraduate medical education: Medical students' perspective. Ann Med Surg (Lond). 2020 Sep 5:58:117-119. doi: 10.1016/j.amsu.2020.08.045. [PMID: 32983429] [PMCID: PMC7493078]
7. Hall AK, Nousiainen MT, Campisi P, Dagnone JD, Frank JR, Kroeker KI, et al. Training disrupted: Practical tips for supporting competency-based medical education during the COVID-19 pandemic. Med Teach. 2020 Jul;42(7):756-761. doi: 10.1080/0142159X.2020.1766669. [PMID: 32450049]
8. Baker DM, Bhatia S, Brown S, Cambridge W, Kamarajah SK, McLean KA, et al. Medical student involvement in the COVID-19 response. Lancet. 2020 Apr 18;395(10232):1254. doi: 10.1016/S0140-6736(20)30795-9. [PMID: 32247322] [PMCID: PMC7270863]
9. Ferrel MN, Ryan JJ. The Impact of COVID-19 on Medical Education. Cureus. 2020 Mar 31;12(3):e7492. doi: 10.7759/cureus.7492. [PMID: 32368424] [PMCID: PMC7193226]
10. Ten Cate O, Schultz K, Frank JR, Hennus MP, Ross S, Schumacher DJ, et al. Questioning medical competence: Should the Covid-19 crisis affect the goals of medical education? Med Teach. 2021 Jul;43(7):817-23. doi: 10.1080/0142159X.2021.1928619. [PMID: 34043931]
11. Kumar D, Varma J, Dongre A, Pandya H. Scoping review of published research on medical education in India during the Covid-19 pandemic. Natl Med J India. 2022 Jul-Aug;35(4): 243-246. doi: 10.25259/NMJI_636_21. [PMID: 36715036]
12. Saunders B, Sim J, Kingstone T, Baker S, Waterfield J, Bartlam B, et al. Saturation in qualitative research: exploring its conceptualization and operationalization. Qual Quant. 2018;52(4):1893-907. doi: 10.1007/s11135-017-0574-8. [PMID: 29937585] [PMCID: PMC5993836]
13. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures, and measures to achieve trustworthiness. Nurse Educ Today. 2004 Feb;24(2):105-12. doi: 10.1016/j.nedt.2003.10.001. [PMID: 14769454]
14. Elo S, Kääriäinen M, Kanste O, Pölkki T, Utriainen K, Kyngäs H. Qualitative content analysis: A focus on trustworthiness. SAGE open. 2014; 4(1): 2158244014522633. doi: 10.1177/2158244014522633.
15. Al-Balas M, Al-Balas HI, Jaber HM, Obeidat K, Al-Balas H, Aborajooh EA, et al. Correction to: Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: current situation, challenges, and perspectives. BMC Med Educ. 2020 Oct 2;20(1):341. doi: 10.1186/s12909-020-02257-4. [PMID: 33008392] [PMCID: PMC7530879]
16. Hayat AA, Keshavarzi MH, Zare S, Bazrafcan L, Rezaee R, Faghihi SA, Amini M, Kojuri J. Challenges and opportunities from the COVID-19 pandemic in medical education: a qualitative study. BMC Med Educ. 2021 Apr 29;21(1):247. doi: 10.1186/s12909-021-02682-z. [PMID: 33926439] [PMCID: PMC8082480]
17. Maatuk AM, Elberkawi EK, Aljawarneh S, Rashaideh H, Alharbi H. The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. J Comput High Educ. 2022;34(1):21-38. doi: 10.1007/s12528-021-09274-2. [PMID: 33967563] [PMCID: PMC8091987]
18. Yazdani S, KHoshgoftar Z, AhmadyS, Foroutan SA. Learning in Cyberspace: A Thematic Content Analysis in Health Learning System. Journal of Qualitative Research in Health Sciences. 2017; 6(3): 296-309.
19. Daniel M, Gordon M, Patricio M, Hider A, Pawlik C, Bhagdev R, et al. An update on developments in medical education in response to the COVID-19 pandemic: a BEME scoping review: BEME Guide No. 64. Med Teach. 2021 Mar;43(3):253-71. doi: 10.1080/0142159X.2020.1864310. [PMID: 33496628]
20. Harries AJ, Lee C, Jones L, Rodriguez RM, Davis JA, Boysen-Osborn M, et al. Effects of the COVID-19 pandemic on medical students: a multicenter quantitative study. BMC Med Educ. 2021 Jan 6;21(1):14. doi: 10.1186/s12909-020-02462-1. [PMID: 33407422] [PMCID: PMC7786337]
21. Franklin G, Martin C, Ruszaj M, Matin M, Kataria A, Hu J,et al. How the COVID-19 Pandemic Impacted Medical Education during the Last Year of Medical School: A Class Survey. Life (Basel). 2021 Mar 30;11(4):294. doi: 10.3390/life11040294. [PMID: 33808274] [PMCID: PMC8065402]
22. Hoernke K, McGrath H, Teh JQ, Salazar O. Virtual Learning Innovations for Continuing Clinical Education during COVID-19. Med Sci Educ. 2020 Sep 30;30(4):1345-6. doi: 10.1007/s40670-020-01090-0. [PMCID: PMC7527243] [PMID: 33020725]
23. Dhillon J, Salimi A, ElHawary H. Impact of COVID-19 on Canadian Medical Education: Pre-clerkship and Clerkship Students Affected Differently. J Med Educ Curric Dev. 2020 Oct 14:7:2382120520965247. doi: 10.1177/2382120520965247. [PMID: 33134548] [PMCID: PMC7576927]
24. Tan KI, Foo J, G Ang BW, Chua JW, Teo DB. Perspectives of medical students on local medical education during COVID-19. Singapore Med J. 2022 Jul;63(7):402-404. doi: 10.11622/smedj.2020105. [PMID: 32668830] [PMCID: PMC9578127]
25. Saoji MB, Ahirwar AK, Kaim K, Ahirwar P. Continuing medical education in Covid-19 pandemic. Horm Mol Biol Clin Investig. 2022 Apr 14;43(3):249-250. doi: 10.1515/hmbci-2021-0102. [PMID: 35420001]
26. Rezaei H, Haghdoost A, Javar HA, Dehnavieh R, Aramesh S, Dehgani N, Sisakht MT. The effect of coronavirus (COVID-19) pandemic on medical sciences education in Iran. J Educ Health Promot. 2021 May 20:10:136. doi: 10.4103/jehp.jehp_817_20. [PMID: 34222511] [PMCID: PMC8224502]
27. .Wajid G, Gedik G. Impact of COVID-19 on health professionals' education in eastern Mediterranean region. East Mediterr Health

J. 2022 Jul 31;28(7):506-514. doi: 10.26719/emhj.22.062. [PMID: 35959666]
28. Brown A, Kassam A, Paget M, Blades K, Mercia M, Kachra R. Exploring the global impact of the COVID-19 pandemic on medical education: an international cross-sectional study of medical learners. Can Med Educ J. 2021 Jun 30;12(3):28-43. doi: 10.36834/cmej.71149. [PMID: 34249189] [PMCID: PMC8263042]
29. Kaul V, Gallo de Moraes A, Khateeb D, Greenstein Y, Winter G, Chae J, et al. Medical Education During the COVID-19 Pandemic. Chest. 2021 May; 159(5): 1949-60. doi: 10.1016/j.chest.2020.12.026. [PMID: 33385380] [PMCID: PMC7772576]
30. Pourfridoni M, Khan MA, Daneshi S, Vazirinasab H, Nosrati Z, Daneshi-Maskooni M. Health literacy and fear among Iranian medical students due to COVID-19: An observational study. Brain Behav. 2022 May;12(5):e2586. doi: 10.1002/brb3.2586. [PMID: 35429408] [PMCID: PMC9110898]
31. Giroldi E, Veldhuijzen W, Geelen K, Muris J, Bareman F, Bueving H, et al. Developing skilled doctor-patient communication in the workplace: a qualitative study of the experiences of trainees and clinical supervisors. Adv Health Sci Educ Theory Pract. 2017 Dec;22(5):1263-1278. doi: 10.1007/s10459-017-9765-2. [PMID: 28220333] [PMCID: PMC5663797]
32. Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. Med Teach. 2013 May; 35(5): 395-403. doi: 10.3109/0142159X.2013.769677. [PMID: 23444891]
33. Chandra S, Mohammadnezhad M, Ward P. Trust and Communication in a Doctor-Patient Relationship: A Literature Review. Journal of Health Care Communications. 2018; 3(3): 36. doi: 10.4172/2472-1654.100146.

Table 1. An example of the process of extracting a theme from semantic units, codes

Category	Subcategory	Primary code	Semantic Units
Ineffective clinical education	Poor management of clinical education planning	unexpected cancellation of educational programs and departments	…We were supposed to visit the patients at the hospital's clinic with the professor. However, to our surprise, the clinic was canceled….
		Decreasing the number of morning reports in major clinical departments (internal medicine, pediatric...).	….and the number of morning reports in core specialties such as pediatrics, gynecology, obstetrics, and internal medicine had been reduced …
		The lockdown of training hospitals with every wave of COVID-19	...all of our clinical rotations were on lockdown with each wave of the coronavirus…
	Clinical resource restriction	shortage of patients, a diverse range of cases, a significant decrease in elective surgery	….only teaching hospital was the COVID-19 center, so we only treated COVID patients. Consequently, the number of general patients and a variety of cases of other diseases decreased….
		the poverty of support and protective equipment (mask, gloves, resting place during night shift)	….at every shift work, the head nurse only gave us one N95 mask. If we took it off for lunch, they wouldn't give us another one….
	Online learning pitfalls	Lack of communication with the professors, lack of focus in virtual classes, Low quality of uploaded files (sound and images)	…I couldn't concentrate in the online class because I didn't interact with the professor…
		Slow internet speed and frequent outages. class fatigue and sleepy	....The infrastructure is poor... the internet speed was low and as a result connection to the class was frequently interrupted and would cause the teacher not to use the webcam...Well, I have been falling asleep…

Table 2. Demographic characteristics of the new general physician during the COVID-19 era

Participant number	Age (year)	Sex	Marital status	Interview Format	Work experience	Workplace
1	26	Female	Marriage	In-person	5 months	Health care center
2	26	Female	Single	In-person	4 months	Hospital
3	26	Female	Single	By phone	6 months	Hospital
4	26	Male	Single	By phone	1 month	Hospital
5	27	Female	Single	By phone	9 months	Hospital
6	25	Male	Single	By phone	6 months	Hospital
7	27	Female	Marriage	In-person	10 months	Health care center
8	27	Female	single	In-person	6 months	Hospital
9	27	Male	Single	By phone	12 months	Hospital
10	28	Male	Single	By phone	12 months	Hospital
11	27	Female	single	In-person	12 months	Health care center

12	26	Female	Marriage	By phone	6 months	Hospital
13	27	Female	single	In-person	6 months	Hospital
14	25	Female	single	By phone	6 months	Hospital
15	27	Male	Single	In-person	8 months	Hospital
16	26	Male	Single	By phone	6 months	Hospital
17	26	Female	single	By phone	6 months	Hospital

Table 3. The categories and subcategories

Category	Subcategories
Ineffective clinical education	Poor management of clinical education planning clinical resource restriction online learning pitfalls
Inadequate Outcome	Skill-needs Attitude- needs Knowledge-needs Deficiency in professional interactions

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Original Article

Exploring Dental Students' Experiences of Clinical Education: A Qualitative Study

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Abstract

Background: Clinical education is the basis of medical education and one of the most important criteria for professional education, which plays a crucial role in consolidating students' learning.

Objectives: This study was conducted to explain the experiences of dental students from one of the universities of medical sciences in Tehran regarding clinical training.

Methods: This qualitative study was conducted in Iran in 2023 using conventional content analysis. Sampling was performed using purposeful sampling. Data were collected through semi-structured individual interviews, which continued until data saturation. Participants included fourteen final-year dental students from one of the dental faculties in Tehran, Iran. Data were analyzed using the method by Graneheim and Lundman. Lincoln and Guba's criteria were used to ensure the accuracy and robustness of the data.

Results: From the data analysis, four categories and ten subcategories were obtained. Categories and subcategories include the skill and ability of the clinical professor (professional characteristics of the clinical professor, professor-student interactions), effective clinical training (professor's educational and teaching ability, the importance of case diversity in better learning, the role of mentoring in learning), weak educational management (inappropriate evaluation, disproportion between the number of instructors and students, inadequacy of facilities and equipment), and a bidirectional learning atmosphere (student motivation and lack of motivation, positive and negative psychological atmosphere).

Conclusion: According to this study's findings, it is recommended that the officials of the studied dental school take action to improve the quality of clinical education and enhance student learning by strengthening the advantages and addressing the existing shortcomings and weaknesses.

Keywords: Clinical Education; Experience; Dental; Qualitative Study; Student

Background

Dental education is a complex field that consists of clinical and theoretical education, with an emphasis on gaining the ability to communicate effectively with patients (1). Practical dental courses, including preclinical and clinical training, are essential for developing students' skills in dental education (2). Many dental schools around the world are reforming their curricula to expose students to clinical care as early as possible, maximize the use of active learning strategies, and engage students in dental care to increase clinical exposure, leading to the competencies needed to provide dental care after graduation (3). Paying attention to and emphasizing the training of skills for students has a significant effect on professional learning in clinical education (4).

The clinical environment is the core of education, and students' feedback on the educational environment is an important factor in the success of education and learning. The World Federation of Medical Education believes that evaluating the educational environment is an important factor in assessing the curriculum and

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learning (5). Although students' experience in clinical education is improving, the expectations of students for learning opportunities, acquiring clinical skills, and feeling a sense of belonging and respect are not always fulfilled (6). Potential deficiencies and problems in the implementation process of the dental education program can hinder the realization of the goals of basic and specialized science courses, and the efficiency and professional ability of graduates in this field may face challenges that have harmful social effects (7).

One of the ways to maintain and improve the quality of education is the continuous evaluation of education and its related elements. Evaluation is a research process that uses quantitative and qualitative methods to understand, judge, and improve an educational activity. In order to ensure the usefulness and effectiveness of the clinical environment in learning, the factors of the clinical environment, students, clinical instructors, and department personnel that affect learning outcomes should be identified and evaluated (8, 9). It is important to note that students and professors are the main pillars of clinical education, and examining their opinions can clarify the strengths and weaknesses of clinical environments (10, 11).

Zaba Naz et al. (2021) conducted a study to compare dental students' opinions about the clinical education system and identify its advantages and disadvantages. The results showed that students experience a good mix of clinical learning opportunities but are not involved as part of the healthcare team, and their time is wasted on many non-clinical activities. Therefore, changes are needed in the current education system (12).

Qaraei et al. (2015) conducted a study on educational problems from the perspective of students of Mashhad Dental School in 2015 through a group discussion with them. The results showed that the majority of the problems faced by students were due to a lack of adequate training. Students were dissatisfied with the state of the library and pointed out that the evaluations were not standardized. They also stated that there was no proportion between the number of students and the faculty (13).

Oderinu et al. (2024), in a study investigating the perceptions of dental students, pointed to results including teacher characteristics, physical facilities, perceived inadequate supervision of teaching, and lack of appropriate feedback on performance (14).

Identifying the status of clinical education and the factors affecting it can help eliminate or correct weaknesses, improve the achievement of educational goals, train skilled individuals, and provide higher-quality care services. Since no study has been conducted on the clinical status of dental students at the University of Medical Sciences, the researchers decided to depict the factors affecting students' clinical learning through a qualitative study based on the students' real experiences. Regarding students' opinions as one of the beneficiaries of education, it can be effective in identifying the status of education in clinical environments. This study was conducted with the aim of explaining the experiences and understanding of dental students from clinical training in one of the dental schools in Tehran, Iran.

Objectives

This study was conducted to explain the experiences of dental students from one of the universities of medical sciences in Tehran regarding clinical training.

Methods

Study design: This research is a qualitative study using a conventional content analysis approach. It was conducted in 2023 in Tehran, Iran.

Study participant/sampling: Participants included 14 dental students from one of the dental schools in Tehran. Sampling was done purposefully. The participants in the study were final-year dental students, all male and between the ages of 25 and 27. The main researcher selected participants from among the final-year students who met the conditions to enter the study. The inclusion criteria were passing the clinical units and the willingness of individuals to share their experiences. Refusal to record the interview was also considered an exclusion criterion.

Data collection: Individual, face-to-face, semi-structured interviews were used to collect data. The duration of the interviews varied from 25 to 45 minutes. Interviews continued until data saturation, which occurs when no new data are obtained from the interviews, leading to the repetition of previous codes (15). Before the interview, the purpose of the study was explained to the participants, and informed consent was obtained. The time and place of the interview were coordinated with the participants, and the interview was conducted face-to-face in a calm environment. The interviews were conducted by the first author, who was a final-year dental student and had completed a training course in qualitative research methods, under the supervision of an expert from the research team. All interviews were recorded with the consent of the participants. Before the first interview, interview questions were prepared and approved by all the authors during several discussion

sessions. The interview began with general questions such as "Tell us about your experience of clinical training," "Please describe a challenge you faced in clinical training," and "Describe an experience you were satisfied with in clinical training," then continued with probing questions such as "Please explain more" and "What do you mean?" based on the previous response to clarify the details and ambiguities and increase the depth of the interviews.

Data analysis: The content of each recorded interview was transcribed verbatim. In order to ensure the correctness of the transcribed content, the recorded audio was listened to again. The interviewing and data analysis processes were done simultaneously. The data analysis was performed using the conventional content analysis method based on the Graneheim and Lundman method (2004) (16). The steps are as follows: 1) transcribing the conducted interviews and reviewing them several times to achieve a correct understanding of all the implemented items, 2) extracting meaning units and classifying them under the title of primary codes, 3) summarizing and categorizing the primary codes under the title of subcategories, 4) sorting the subcategories by comparing the similarities and differences in the categories, and 5) choosing the appropriate title under the main theme that can cover the categories.

Trustworthiness and rigor: In this study, four criteria (credibility, dependability, confirmability, and transferability) were used to ensure the trustworthiness and reliability of the data (Lincoln and Guba, 1986) (17). After the initial coding, and to ensure the credibility of the findings, the methods of member checking, immersion, and prolonged engagement with the data were used. To ensure the accuracy of the data, the opinions of the professors on the research team and two professors outside the research team, who had experience in conducting qualitative research, were used in the process of interviews, initial coding, and conceptual classes (peer check).

Ethical considerations: Ethical considerations were observed in conducting the research. The objectives and nature of the research were explained to the participants, and informed written consent was obtained from them to participate in the research. All participants were assured that their personal information would remain confidential.

Results

Based on the analysis of the findings from the students' interviews, two main themes, including the strengths and weaknesses of clinical education, were identified, with four categories and nine subcategories (Table 1).

The skill and ability of the clinical professor

Professional characteristics of the clinical professor: The participants in the study stated that the professors were often conscientious and guided and helped the students in learning the material. However, sometimes there were professors whom they did not always have access to. One of the students stated in this regard: "... the professors were very good in terms of science and literacy; they were available and provided us with any questions and guidance we needed. Of course, there were a few professors who were not always available and did not show much motivation to teach the students." *(p.4)*

Professor-student interactions: In this regard, the experiences of the participants showed that treating students respectfully, professors' good manners, and professors' patience in answering questions facilitate the process of clinical education. Of course, in some cases, the clinical professor had a non-scientific approach to the students, or sometimes the students were faced with harsh professors, which was not a pleasant experience for them. One of the students said: "…*Despite the stress we had because of the anxiety of presenting work, the professors had a good relationship with us, they gave us peace, especially during work, if we did well, they gave us a lot of approval, they gave us confidence, and this made us continue our work well….*" *(P.2)*

Effective clinical training

This category includes three subcategories: the professor's educational and teaching ability, the importance of case diversity in better learning, and the role of mentoring in learning.

Professor's educational and teaching ability: Some of the participants stated that the professors in the clinical departments were trying to teach scientific and practical points and transfer experiences to the students, and by providing appropriate explanations, questions and answers, and student participation, they helped facilitate better learning of educational materials. Of course, some professors were not like this, and the students faced challenges with these professors. One of the students said:*" I had a good training experience in many departments.*

For example, the last patient I saw, was a case of CL (crown lengthening) for comprehensive treatment, which the professor explained to me very well in detail and answered the questions completely, and we learned good

things and the professor explained the clinical points in detail." (P.9)

The importance of case diversity in better learning: Some students participating in the study stated that in most clinical departments, they had the experience of encountering different cases and patients, and the professors selected various cases to enhance student learning. Of course, in a few departments, there was a lack of patients and a lack of case diversity, which created challenges in learning practical cases in the relevant department. In this regard, one of the students stated: *"…... for example, department of oral medicine was one of the best clinical departments, the number of patient loads was high, and the professor gave a full explanation for each patient, and we understood the educational materials well…." (P.5); "…absence of patients was one of the learning challenges in some cases…." (P.14); "Our challenge was mostly the challenge of the patient, and we were in dire straits in terms of lack of the patients, and because of this, we could not see some of the cases that we should have seen." (P.8)*

The role of mentoring in learning: A professional relationship in which an experienced and knowledgeable person (mentor) helps another person (mentee) improve and develop their knowledge and skills in a professional field. Students believed that technicians play an important role in clinical education alongside professors.*"…The relevant technicians explained the materials very well to us and were always available and we could solve our problems with them…." (P.9); "Preclinic assistants were good in terms of providing the equipment and dealing with the students…." (P.8)*

Weak educational management

This category includes three subcategories: inappropriate evaluation, disproportion between the number of instructors and students, and lack of educational facilities and equipment.

Inappropriate evaluation: Evaluation is an important component of any educational process. It is one of the key aspects of educational activities, providing the opportunity to determine strengths and weaknesses based on the results. The participants pointed out the inappropriateness of academic tests and clinical grading, as well as the lack of proper feedback. In this regard, one of the students stated: *"...one of the problems was the taste of the professors' grading in some of the departments in such a way that one professor evaluates a student's clinical work as good, but another professor does not evaluate the same work as good, and the grading criteria changes…" (P.4); "It is better for clinical professors to be above the students' heads when the student is working on the patient in the clinical department, and check the work step by step and tell the student the problems of the work at the same time." (P.1)*

Disproportion between the number of instructors and students: The proportion of faculty members to students is of particular importance. The student-to-faculty ratio affects the working conditions of academic staff and the quality of student-teacher interactions, which in turn influences students' academic achievements. Most of the study participants mentioned the lack of professors in clinical departments. Participant 13 said, *"The shortage of professors was felt in all departments, and sometimes we had to wait for the professor to come and check the patient, and it took a lot of time."*

Inadequacy of facilities and equipment: The participants pointed to the lack of consumables, the lack of tools in some situations, the damage of equipment and facilities in some clinical departments, and the failure of some units. In this regard, one of the students said: *"…one of the challenges is the low quality of some of the materials used in the faculty, and some of the materials that are past their use-by date, cause the quality of our work to go down…" (P.6); "…In some clinical departments, we didn't have healthy tools sometimes, some of the turbines were broken, the dental units were not working well. There was also a lack of equipment at the prosthesis clinic." (P.5); "Another problem was the lack of advanced facilities and not using them. For example, rotary could be used in endo. At least professors would teach us to get familiar, or they could have used newer bands and more up-to-date tools in the restorative department and endo departments, there was no apex locator, they did not teach the students how to determine length or use the rotary device and rotary files and the students learned by themselves." (P.7)*

Bidirectional learning atmosphere

This category includes two subcategories: students' motivation and lack of motivation, as well as positive and negative psychological atmosphere. Some of the participants in the study stated that they were eager and interested in learning, while others expressed reluctance to learn some materials. Some students expressed stress and worry about doing practical work correctly, while others felt relaxed and confident about performing it. Emotional support for students and encouragement to learn were among the aspects mentioned by the students. Of course, they also said that the professors blamed the students for some of their working conditions. In this regard, we refer to the statements of some students

participating in the study. "... *Some departments were strict and it made a person feel discouraged and not motivated enough to learn from that department and just want to pass that course..." (P.4)*

"... In some clinical departments, less stress was applied to the student, and this less stress made the student do the work easier and better. The student got a good feeling about the lesson given by the professor, self-motivation. We were motivated and encouraged to learn and perform proper treatment due to less stress..." (P.1)

Discussion

This qualitative study was conducted with the aim of explaining the experiences of dental students regarding clinical training in one of the Iranian dental schools. Analyzing the experiences of the participants led to the extraction of four categories: "the skill and ability of the clinical professor," "effective clinical training," "weak educational management," and "bidirectional learning atmosphere." The skill and ability of the clinical professor included two subcategories: professional characteristics of the clinical professor and professor-student interactions. Clinical environments are key places for medical students to learn, especially dental students. Clinical professors and educators must possess specific skills in the fields of knowledge, communication, and work, as well as in evaluation, and know how to use them effectively. The professor's up-to-date scientific knowledge, responsibility, conscientiousness, respectful treatment of students, and good manners were among the codes related to the experiences of the students in the study. In line with the present study, the results of Reising et al.'s study showed that the instructor's ability to transfer knowledge, professionalism, and enthusiasm are key characteristics that affect the clinical experience (18). Tang and colleagues believe that having professional ethics, a supportive spirit, up-to-date information, respect for others, and appropriate appearance are the most important characteristics of an effective instructor in teaching students (19).

In the current study, the students believed that the constructive interaction between the professor and the student can have an important impact on the educational process. In line with these results, the study by Mohammadimehr and Mirmoghtadaie showed that one of the important issues in students' success in learning is paying attention to and supporting interactions between students and professors. It is necessary to provide a suitable platform for creating and supporting these interactions (20). The interaction between the teacher and the student leads to the improvement of the learning experience (21). Viktorov and Hogan noted that the professor's characteristics required to achieve effective teaching include a positive and friendly personality and focused interaction with students, which is consistent with the themes obtained in the present study, including effective interaction with students and continuous supervision (22).

Consistent with the findings of this study, the category of effective clinical training included three subcategories: the professor's educational and teaching ability, the importance of case diversity in better learning, and the role of mentoring in learning. Most of the students stated that effective teaching in some educational departments led to better learning. In line with the findings of the present study, the results of the studies by Galli et al. and Sagsoz et al. showed that collaborative learning methods and group discussions, compared to the traditional method, result in better learning with higher motivation in students (23, 24). Munna and Kalam (2021) stated that the effectiveness of teaching means evaluating the effectiveness of the measures taken to achieve the predetermined goals. Effective teaching should be regular, motivating, and arouse students' interest (25).

Based on the results of this study, weak educational management includes three subcategories: inappropriate evaluation, disproportion between the number of instructors and students, and inadequacy of facilities and equipment. According to the students' point of view in the present study, unfair grading, lack of appropriate criteria in grading, grading according to the professors' preferences, and not providing feedback to students lead to inappropriate evaluation. In line with the results of the present study, the results of Ahmad Mehrabi et al.'s study (2020) at Shahid Beheshti Dental School indicated that professors' lack of attention to giving feedback to students after each evaluation and the application of professors' personal opinions in grading students' performance were among the weak points of the educational and evaluation program (26). The results of the present study also indicated a lack of consumables, a lack of tools in some situations, and damaged equipment and facilities in some clinical departments. In this regard, Foroughi et al.'s study (2023), by examining the views of students at Babol Dental School, showed that the physical equipment of the departments and materials needed by the students in each department were in moderate to good condition.

However, considering that the quality of dental treatments and clinical training is highly dependent on high-quality equipment and materials, there is still a need to improve and update the physical equipment and materials needed by students (27). Researchers have highlighted the importance of the learning environment and learning resources as important factors that influence teaching and learning (28, 29). In addition, lessons learned from the COVID-19 pandemic, advanced facilities, and the use of new technological devices and simulation-based training should be incorporated into the training program of dental students (30).

Based on the results of the present study, one of the categories was a bidirectional learning atmosphere. The learning environment, as one of the main components of academic success and student satisfaction, has received special attention from policymakers in the field of medical education in recent years (31). The clinical environment includes all cognitive, cultural, social, psychological, emotional, educational, and motivational factors (32). In the present study, some of the participants stated that they were motivated, relaxed, and had a good feeling about learning, while others were unmotivated and stressed. The atmosphere governing education can strengthen positive behaviors toward educational improvement by creating motivation (33). In line with this study, the results of Basudan et al.'s (2017) study at King Saud University School of Dentistry showed a high incidence of depression, anxiety, and stress among dental students and the importance of providing support programs and implementing preventive measures to help students, especially those who are more susceptible to these psychological conditions (34).

The participants in the study stated that some of the clinical departments had a favorable and safe learning environment. According to the results of other studies, a psychologically safe environment can calm students' minds and thus increase learning. The findings of Honaramiz Fahim's study showed that the perception status of medical and dental students in clinical courses at Shahed University is in a semi-desirable condition regarding the educational environment (33). Today, attention is being paid to the importance of the effect of the educational environment on students' learning, and the quality of the educational atmosphere is known as an important indicator of the effectiveness of educational programs (29, 35, 36). One of the things to consider in order to improve health services in clinical environments is to strengthen creativity and increase innovation among students, faculty members, and employees (37).

The findings of the present study were obtained from the experiences of students at one of the dental schools in the capital of Iran. Due to the qualitative nature of the research, they may not be generalizable to other dental schools. It is also possible that the participants did not disclose all the information due to considerations such as fear of the faculty officials and administrators. Of course, the researchers tried to reduce this limitation by assuring the participants that the information would not be disclosed.

Conclusion

This study was conducted to explain the experiences and understanding of dental students regarding clinical education in one of the dental schools in Iran. The findings of this study showed that the experiences of dental students were categorized as "the skill and ability of the clinical professor, effective clinical training, weak educational management, and bidirectional learning atmosphere." The participants expressed professional characteristics of the clinical professor and professor-student interactions as experiences related to the skill and ability of the clinical professor. Based on the results of the students' experiences in this study, the professional characteristics of the clinical professor and professor-student interactions were related to the experience of the clinical professor's skill and ability. In contrast, the professor's educational and teaching ability, the importance of case diversity in better learning, and the role of mentoring in learning were related to the experience of effective clinical training. According to the results of this study, weaknesses in student monitoring and evaluation, disproportion between the number of instructors and students, and inadequacy of facilities and equipment were associated with the experience of weak educational management. In addition, students' motivation and lack of motivation, along with the positive and negative learning atmosphere, were related to the experience of a bidirectional learning atmosphere. Based on these results, managers, educational officials, and clinical professors at the studied faculty can provide a more suitable context for clinical training and more effective learning for dental students by strengthening the positive aspects and addressing the challenges and negative points identified in the students' experiences. In this regard, supporting mechanisms, creating a

collaborative atmosphere in student activities, establishing appropriate interpersonal relationships in clinical environments through positive feedback, encouraging rather than criticizing, building self-confidence in students, implementing new methods of clinical education, and paying attention to the role model are recommended.

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References

1. Quick KK. A humanistic environment for dental schools: What are dental students experiencing? J Dent Educ. 2014 Dec;78(12):1629-35. doi: 10.1002/j.0022-0337.2014.78.12.tb05841.x. [PMID: 25480278]
2. Hassan R, Khalifa AR, Elsewify T, Hassan MG. Perceptions of Clinical Dental Students toward Online Education during the COVID-19 Crisis: An Egyptian Multicenter Cross-Sectional Survey. Front Psychol. 2022 Jan 7:12:704179. doi: 10.3389/fpsyg.2021.704179. [PMID: 35069304] [PMCID: PMC8776649]
3. Atiah N, Dahlseide P, Sharmin N, Ganatra S, Perez A. Dental students' perceptions of instructor storytelling for clinical learning: A qualitative description study. J Dent Educ. 2024 Jan;88(1):92-99. doi: 10.1002/jdd.13396. [PMID: 37867282]
4. Malekpour-Tehrani A, Moezzi M, Hosseini SS, Hosseini SM. Evaluation and comparison of clinical rounds from the perspective of professors and students of Shahrekord university of medical sciences. Journal of Medical Education and Development. 2021;16(2):131-41. doi: 10.18502/jmed.v16i2.7146. [In Persian]
5. Fathi M, Valiee S. Nursing, Midwifery and Operations Room students` perception of the educational environment of Kurdistan University of Medical Sciences. Journal of Education Strategies in Medical Sciences. 2019;12(3):12-22. doi: 10.22038/jhl.2019.36772.1019. [In Persian]
6. O'Driscoll MF, Allan HT, Smith PA. Still looking for leadership: Who is responsible for student nurses' learning in practice? Nurse Educ Today. 2010 Apr;30(3):212-7. doi: 10.1016/j.nedt.2009.12.012. [PMID: 20172633]
7. Goedhart H, Eijkman MA, ter Horst G. Quality of dental care: the view of regular attenders. Community Dent Oral Epidemiol. 1996 Feb;24(1):28-31. doi: 10.1111/j.1600-0528.1996.tb00808.x. [PMID: 8833511]
8. Moattari M, Ramazani S. Nursing Students' Perspective toward Clinical Learning Environment. Iranian Journal of Medical Education 2009; 9(2):137-45. [In Persian]
9. Shoja M, Arsalani N, Rasouli P, Babanataj R, Shirozhan S, Fallahi-Khoshknab M. Challenges of clinical education for Iranian undergraduate nursing students: A review of the literature. Iranian Journal of Systematic Review in Medical Sciences. 2023;1(3):46-60. [In Persian]
10. Sandow PL, Jones AC, Peek CW, Courts FJ, Watson RE. Correlation of admission criteria with dental school performance and attrition. J Dent Educ. 2002;66(3):385-92. doi: 10.1002/j.0022-0337.2002.66.3.tb03517.x. [PMID: 11936229]
11. McGrath C, Wai Kit Yeung R, Comfort MB, McMillan AS. Development and evaluation of a questionnaire to evaluate clinical dental teachers (ECDT). Br Dent J. 2005 Jan 8;198(1):45-8. doi: 10.1038/sj.bdj.4811957. [PMID: 15716893]
12. Naaz Z, Singh SV, Arya D, Aggarwal H, Pathak A. A Study on Assessment of Clinical Education Standards of an Indian Government Dental College by Students. Journal of Orofacial Research. 2021;10(4):59-68.
13. Gharaei Sh, Kargoza S, Amirchakhmaghi M, Gholami H. Students' Viewpoints of Mashhad Dental School about Educational Problems a Qualitative Study. Educ Strategy Med Sci 2015; 8 (2): 123-30. [In Persian]
14. Oderinu OH, Balogun M, Pugsley H. Exploring dental students' perceptions of their clinical learning environment: A qualitative study to evaluate the curriculum. International Journal of Research in Education and Science. 2024:10(2), 279-98. doi: 10.46328/ijres.3364.
15. Rostami M, Babajani-Vafsi S, Ziapour A, Abbasian K, Mohamadimehr M, Zareiyan A. Experiences of operating room nurses in disaster preparedness of a great disaster in Iran: a qualitative study. BMC Emerg Med. 2023 Nov 23;23(1):138. doi: 10.1186/s12873-023-00903-w. [PMID: 37996807] [PMCID: PMC10668482]
16. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. Nurse Educ Today. 2004 Feb;24(2):105-12. doi: 10.1016/j.nedt.2003.10.001. [PMID: 14769454]
17. Lincoln YS. Guba EG. Naturalistic Inquiry. Beverly Hills, California: Sage Pub;1985. doi: 10.1016/0147-1767(85)90062-8.
18. Reising DL, James B, Morse B. Student perceptions of clinical instructor characteristics affecting clinical experiences. Nurs Educ Perspect. 2018 Jan/Feb;39(1):4-9. doi: 10.1097/01.NEP.0000000000000241. [PMID: 29189467]
19. Tang FI, Chou SM, Chiang HH. Students' perceptions of effective and ineffective clinical instructors. J Nurs Educ. 2005 Apr;44(4):187-92. doi: 10.3928/01484834-20050401-09. [PMID: 15862053]
20. Mohammadimehr M, Mirmoghtadaie Z. Exploring the components of student support system in blended learning for Iranian Universities of Medical Sciences: A thematic analysis. J Educ Health Promot. 2021 May 20:10:130. doi: 10.4103/jehp.jehp_863_20. [PMID: 34222505] [PMCID: PMC8224492]
21. Mohammadimehr M, Haji J. Identifying the factors affecting on interaction of faculty member: A meta-synthesis. J Educ Health Promot. 2022 Oct 31:11:343. doi: 10.4103/jehp.jehp_1602_21. [PMID: 36568014] [PMCID: PMC9768717]
22. Victoroff KZ, Hogan S. Students' perceptions of effective learning experiences in dental school: a qualitative study using a critical incident technique. J Dent Educ. 2006 Feb;70(2):124-32. doi: 10.1002/j.0022-0337.2006.70.2.tb04068.x. [PMID: 16478926]
23. Gali S, Shetty V, Murthy NS, Marimuthu P. Bridging the gap in 1(st) year dental material curriculum: A 3-year randomized cross over trial. J Indian Prosthodont Soc. 2015 Jul-Sep;15(3):244-9. doi: 10.4103/0972-4052.161565. [PMID: 26929520] [PMCID: PMC4762329]

24. Sagsoz O, Karatas O, Turel V, Yildiz M, Kaya E. Effectiveness of Jigsaw learning compared to lecture-based learning in dental education. Eur J Dent Educ. 2017 Feb;21(1):28-32. doi: 10.1111/eje.12174. [PMID: 26547392]
25. Munna AS, Kalam MA. Teaching and learning process to enhance teaching effectiveness: a literature review. International Journal of Humanities and Innovation (IJHI). 2021;4(1):1-4. doi: 10.33750/ijhi.v4i1.102.
26. Ahmad Mehrabi M, Sadeghipour Roudsari M, Dalaie K, Namdari M, Behnaz M. Shahid Beheshti dental students' perspective on clinical course evaluation methods. Iranian Journal of Medical Education 2020; 20:103-13. [In Persian]
27. Foroughi S, Seyedmajidi S, Ghorbanipour R. Evaluation of Students' Perception about the Quality of Clinical Education in Babol School of Dentistry in 2020-2021. Medical Education Journal. 2023;11(1):65-75. [In Persian]
28. Attayib Umar AM. The Effect of Classroom Environment on Achievement in English as a Foreign Language (EFL): A Case Study of Secondary School Students in Gezira State: Sudan. World Journal of English Language. 2017;7(4): 1-10. doi: 10.5430/wjel.v7n4p1.
29. Zarei A, Haji J, Ghorbani M, Mohammadimehr M. Students' Perspectives on Clinical Education environment in a Military Medical University. Res Med Edu. 2023; 15 (1): 22-30. doi: 10.32592/rmegums.15.1.22. [In Persian]
30. Clemente MP, Moreira A, Pinto JC, Amarante JM, Mendes J. The Challenge of Dental Education after COVID-19 Pandemic - Present and Future Innovation Study Design. Inquiry. 2021 Jan-Dec: 58:469580211018293. doi: 10.1177/00469580211018293. [PMID: 34105420] [PMCID: PMC8193649]
31. Atmani M, Jasemi Khalyani M, Radfar M, Khalkhali H. Investigating the relationship between reception of clinical learning environment with clinical competence in nursing students of Urmia university od medical science in 2019. Nursing and Midwifery Journal. 2021; 19(6):427-36. doi: 10.52547/unmf.19.6.427.
32. Myint K, See-Ziau H, Husain R, Ismail R. Dental Students' Educational Environment and Perceived Stress: The University of Malaya Experience. Malays J Med Sci. 2016 May;23(3): 49-56. [PMID: 27418869] [PMCID: PMC4934718]
33. Honaramiz Fahim K, Johari Z. Evaluation of educational environment in viewpoints of medical and dental students of Shahed university based on DREEM model in the year 2021. Daneshvar Medicine. 2022; 30(1):46-58. doi: 10.22070/daneshmed.2022.15220.1130. [In Persian]
34. Basudan S, Binanzan N, Alhassan A. Depression, anxiety and stress in dental students. Int J Med Educ. 2017 May 24:8: 179-186. doi: 10.5116/ijme.5910.b961. [PMID: 28553831] [PMCID: PMC5457790]
35. Gil YM, Hong JS, Ban JL, Kwon JS, Lee JI. Dental students' perception of their educational environment in relation to their satisfaction with dentistry major: a cross-sectional study. BMC Med Educ. 2023 Jul 17;23(1):508. doi: 10.1186/s12909-023-04485-w. [PMID: 37461010] [PMCID: PMC10351200]
36. Arabi M, Abolfazli M, Riahi S, Nosrati S, Tajbakhsh R. The Educational Environment of Main Clinical Wards in Educational Hospitals of the Alborz University of Medical Sciences. Alborz University Medical Journal. 2021; 10 (3):277-284. doi:10.29252/aums.10.3.277. [In Persian]
37. Araei M, MohammadiMehr M. The Mediating Role of Organizational Learning in the Relationship between Knowledge Management and Organizational Innovation (Case Study: Faculty Members of a Military University). J Mil Med. 2020; 22:373-83.

Table 1. Categories, subcategories, and primary subcategories

Categories	Subcategories	Primary subcategories
The skill and ability of the clinical professor	Professional characteristics of the clinical professor	Teacher availability, cooperation with students, appropriate guidance for students, effective effort to educate students, professor's up-to-date scientific knowledge, professor's responsibility, professor's conscientiousness, professor's motivation in teaching, lack of access to some professors, and lack of motivation in a few professors
	Professor-student interactions	Respectful treatment of students, the good manners of the professors, professors' patience in answering questions, unscientific treatment of students in some cases, and hot-tempered professors in some situations
Effective clinical training	Professor's educational and teaching ability	Teaching scientific and practical tips, good teaching and training, professor's emphasis on transferring experiences to students, full teaching and detailed examinations, giving suitable explanations to solve students' problems, browsing the contents with questions and answers, better learning by holding a seminar, emphasis on discussion in student learning, involving students in teaching and learning, ineffective training in some cases, and inappropriate demonstrations
	The importance of case diversity in better learning	Appropriate number and variety of patients, allowing the student to see different cases, increasing students' experience by seeing more cases, and lack of patients and cases in some situations
	The role of mentoring in learning	The effective cooperation of the instructor in the training process, coach availability, appropriate explanations of educational materials by the assistant, effective guidance to the student by the instructor and assistant, good teaching of the material by the instructor and assistant, and lack of cooperation from assistants in some situations
Weak educational management	Inappropriate evaluation	Unfair grading, lack of appropriate criteria in grading, grading according to the preferences of professors, and not giving feedback to the student
	Disproportion between the number of instructors and students	Few professors in the departments and a lack of assistants compared to the number of students in the departments
	Inadequacy of facilities and equipment	Lack of some consumables, lack of tools in some situations, damaged equipment and facilities in some clinical departments, and failure of some dental units
Bidirectional learning atmosphere	Student's motivation and lack of motivation	Student's enthusiasm and reluctance to learn, the student's good feeling toward the lesson and the teacher, peace and worries for the student, the student's fears in some situations, and stress on students
	Positive and negative psychological atmosphere	Emotional support for students, understanding students, encouraging students to learn, destruction of students in critical conditions, strictness and a dry educational atmosphere in some conditions, the student's feeling of peace in asking the professor, giving calmness and self-confidence to the student during performance, and student discouragement in some situations

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Original Article

A Model for Improving the Capabilities of Talented Students: A Phenomenological Study

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Abstract

Background: Higher education institutions have maintained a longstanding commitment to the education and development of academically talented students, consistently seeking to identify, attract, empower, and support this population.

Objectives: The current research has developed a holistic framework intended to mitigate the available obstacles for academically talented students' success and facilitate favorable outcomes.

Methods: This phenomenological study explored the experiences of 50 talented students, specifically examining the challenges they encountered. Through in-depth interviews, focus groups with experts, and a comprehensive literature review, a practical guide was developed, grounded in Keller's motivational model, to identify and manage challenges and empower gifted learners.

Results: The research identified a central theme, "the narrow alley of talented students," and six sub-themes. Through the information and concepts extracted from interviews, expert focus group discussions, and a comprehensive literature review, the study developed a conceptual model comprising four key categories: Attention, relevance, confidence, and satisfaction. This model effectively transformed abstract explanatory concepts into practical guidelines and actionable solutions.

Conclusion: The proposed strategies within this study offer remarkably beneficial. Overlooking the unique needs of these individuals can culminate in decreased motivation and misallocation of financial resources. The findings of this research can be leveraged by students, professors, and educational administrators to empower these invaluable assets to the academic system.

Keywords: Students; Motivation; Education; Qualitative Research; Universities; Health Professions

Background

The identification, recruitment, development, and support of talented students have long been a central focus for numerous higher education institutions (1). The concept of 'talent' encompasses a multifaceted construct, encompassing not only high cognitive abilities but also academic excellence, creativity, and motivation (2). To be recognized as a talented student, individuals typically exhibit a confluence of intellectual capacity, intrinsic motivation, strong self-confidence, and creativity (3). Renzulli (2012) proposes that, as outlined in the three-ring model, a comprehensive identification of talent should encompass not only cognitive ability but also creativity and motivation (4).

A growing body of research has focused on the experiences of talented students in recent years (2). While universities actively seek to enroll talented students, empirical evidence regarding their successful transition to higher education across diverse academic settings remains limited (5). Notably, talented students encounter a range of challenges and obstacles beyond their intellectual capabilities. The successful adaptation

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and academic achievement of these students within the higher education system are significantly influenced by the support provided by the university, family, and societal structures (5).

While possessing inherent talent is a prerequisite, it does not invariably translate into superior academic performance among talented students (2), and a significant proportion of such students fail to realize their entire potential (6). A critical factor impacting academic achievement in this population is a deficiency in motivation (7), a concern that has long preoccupied educators, parents, and researchers. It impedes both academic progress and the overall self-actualization of these students (8). Fostering and sustaining motivation is paramount for nurturing talent and maximizing academic performance in this population (7). Empirical research has consistently demonstrated a mediating role for motivation in the relationship between conscientiousness and openness to experience and subsequent academic success (6). Establishing a conducive socio-emotional environment exerts a profound influence on various aspects of student self-esteem, motivation, self-perception, academic performance, and successful social integration (2).

Instructional design constitutes a cornerstone of specifying appropriate learning approaches, determining learner needs, developing relevant instructional materials, and facilitating the acquisition of new knowledge and skills. Despite the constructivist learning approach, it is imperative for students to engage in the learning process in an effective and active manner. Motivation serves as a critical catalyst for active student engagement in the learning process (9). Its influence extends beyond mere participation, significantly impacting the overall learning process and its ultimate outcomes (10). Keller's motivational model, renowned for its adaptability, has proven effective in enhancing learning motivation and improving outcomes across diverse domains (11). Keller conceptualizes motivation as an individual's "expectations, choices, and commitments," emphasizing the core question of "why we do what we do" (9). Empirical evidence from previous research supports the efficacy of Keller's model in sustaining and augmenting student motivation (12-15). Dinçer's (2020) meta-analysis revealed that the type of educational materials employed has a more pronounced effect on younger learners, with prolonged exposure to these materials correlating positively with increased student motivation (16). A significant disparity between students' needs and the provision of university programs can culminate in diminished student motivation (17). Additionally, developmental perspectives underscore the dynamic nature of talents, suggesting that they evolve over time rather than remaining static (7). When educational systems fail to nurture students' potential, it results in diminished motivation among learners (17). The holistic development of talented students necessitates an interdisciplinary approach, which in turn demands adequate human and material resources within educational institutions to foster both academic and social growth (2). While theories have consistently emphasized the pivotal role of motivation, most research has been primarily concerned with identifying motivational characteristics and their influence on student growth. Consequently, our understanding of the educational implications and outcomes for highly motivated students remains relatively limited (18).

To facilitate meaningful improvements, university stakeholders must conduct a comprehensive analysis of the current state of affairs and students' experiences with existing services. By identifying both the strengths and weaknesses of these services, university officials can implement targeted strategies to optimize student support and maximize their potential.

Objectives

This research aims to explore the obstacles encountered by talented students and to develop a framework designed to optimize their potential.

Methods

Type of the Study: This research employed a phenomenological approach to investigate the students' lived experiences, specifically focusing on the challenges they encountered. Phenomenology, as a research methodology, centers on understanding human experiences through in-depth interviews, narratives, and observational accounts, emphasizing participants' conscious experiences, including their judgments, perceptions, and emotional responses (7). Furthermore, phenomenology delves into the unique significance of these experiences, examining how events manifest themselves to us. It also seeks to uncover the origins of their understanding and insights into their lived experiences (8). Employing the framework of hermeneutic phenomenology, this study investigated the lived experiences of talented medical science students to develop a model for optimizing their potential. Hermeneutic methodology posits that comprehending human experiences necessitates a

holistic consideration of their contextual milieu, encompassing historical, environmental, and textual background. This approach underscores the temporal continuity of events, from the past to the present. Moreover, researchers are urged to prioritize an understanding of the underlying intentions and motivations that drive these social phenomena, rather than solely focusing on the subjects' observable behaviors (19).

Part 1

Participants: A purposive sampling approach was employed to select 50 participants for this study. The participants were drawn from the Talents Committee at Mashhad University of Medical Sciences. A list of eligible students, including their names and contact information, was obtained from the university's talent unit. To ensure a diverse sample, selection criteria included factors such as field of study, academic semester, living arrangements, marital status, gender, and age. The demographic characteristics of the participants are summarized in Table 1.

Table 1. The demographic characteristics of the participants

School			
Male	**Female**	**Age (mean (SD))**	**GPA**
School of Medicine			
12	6	21.11 (0.87)	16.97 (1.22)
School of Health			
3	3	22.17 (1.95)	17.34 (1.02)
School of Dentistry			
3	4	21.2 (2.04)	17.18 (1.02)
School of Nursing and Midwifery			
4	11	23.27 (3.13)	18.30 (0.44)
School of Para-medicine			
2	2	21.75 (2.16)	16.62 (0.49)
Total			
24	26	21.1 (2.35)	17.51 (1.09)

GPA: Grade point average

Data Collection: Data collection was facilitated through semi-structured individual interviews. An open-ended interview guide served as a framework for inquiry. The key areas of exploration during interview included:

1. How did you feel when you were selected as a talented student?
2. Tell your story about the challenges you encountered in this field.
3. What challenges have you experienced in this field?
4. Explain your feelings and perceptions from joining the talent team.
5. What do you compare being a talent to?
6. What items are important to you? What are your requirements and challenges?
7. What are your experiences and perceptions about family, academic, and social factors associated with you?
8. If there are any additional problems, please state them. Could you provide instances to help me understand your meaning better? If you want to discuss anything else, feel free to let me know.

Prior to commencing the interviews, participants were provided with a detailed explanation of the study's objectives and its potential applications. Following this, informed consent was obtained from all participants through verbal agreement. Participants were explicitly informed of their right to withdraw from the study at any time. To ensure confidentiality, participant names were replaced with letters in all research reports. No incentives were offered to participants for their involvement. Interviews were conducted remotely via the WhatsApp and Telegram platforms, with a mean duration of 40-60 minutes. Participants were guided through a structured interview protocol, responding to sequentially presented questions via voice messages. Moreover, probing questions were asked in a timely manner as necessary throughout the interview process. Participants provided informed consent for future additional inquiries, and data collection continued until theoretical saturation was reached (20).

Data Analysis: This study employed a qualitative data analysis approach based on Collaizzi's seven-step method:

1. The researchers conducted a thorough immersion into the collected data, meticulously examining the participants' descriptions and findings.
2. Key sentences, terminology, and assertions pertaining to the phenomenon were meticulously selected and extracted.
3. The researchers derived meaningful interpretations directly from substantial statements extracted from the data, exercising meticulous care to minimize the influence of prior assumptions.
4. The derived meanings were subsequently organized into thematic categories. Researchers cross-referenced these categories with the original data to eliminate any inconsistencies.
5. The researcher synthesized the identified themes to create a comprehensive account.

6. The researchers distilled their explanation down to a single, concise statement, highlighting only the most crucial structural components of the phenomena.
7. The participants conducted a critical evaluation of the analytical findings to ascertain their validity (21).

Data Validity: To uphold principles of reflexivity and bracketing (Epoche), the research team diligently strove for self-awareness regarding their inherent biases, pre-existing assumptions, and individual viewpoints. This involved a systematic process of documenting and critically examining identified biases. The researchers dynamically adjusted their understanding in light of their ongoing engagement with the data. Furthermore, they actively shared their perspectives with one another, facilitating the identification of any latent biases. Throughout the data analysis and interpretation phases, a conscious acknowledgement of personal biases was maintained.

Part 2

Building upon the findings and challenges elucidated in the initial phase of our research, we developed a preliminary model grounded in Keller's Motivational Theory. This model offers a pragmatic framework for the identification, management, and empowerment of talented students.

Keller's model posits that an individual's motivation is a dynamic interplay of personal traits, environmental stimuli, and learning materials. This model is characterized by four key elements: Attention, relevance, confidence, and satisfaction. In the context of educational design, educators should prioritize strategies that ignite and sustain student attention and curiosity. Moreover, learning materials ought to be meticulously designed to resonate with the students' unique requirements and goals, thereby fostering a sense of self-efficacy and ultimately culminating in a sense of accomplishment and positive learning outcomes (22).

The primary objective at this stage was to formulate a practical guidelines for identifying and managing challenges, as well as empowering talented students. To this end, the abstract and theoretical knowledge gleaned from the preceding phase was translated into practical solutions. In fact, the previously generated knowledge serves as the bedrock upon which this model is constructed. This model comprises a framework that delineates the necessary steps for effective student empowerment. To address any knowledge gaps, interviews with expert focus groups and a comprehensive literature review were undertaken.

Participants: The study cohort in this part of the study comprised 14 experts, consisting of professors, faculty members, educational administrators, and medical education specialists.

Data Collection: Two distinct expert focus groups were convened. The first group consisted of six experts, while the second group comprised eight experts. Both groups participated in two separate two-hour sessions.

To guarantee the comprehensiveness of the developed model, a comprehensive literature review was undertaken. This review, conducted in an unsystematic manner, encompassed various sources pertaining to the talented students' motivation, including relevant articles and books, pertinent regulations, etc.

Data Analysis: Qualitative data were analyzed using a guided content analysis approach aligned with the framework of Keller's motivational model. Guided content analysis is a systematic methodology for examining and interpreting textual or visual data without introducing researcher bias. This approach is particularly valuable for adapting and applying existing theories to new contexts or for further refining the understanding of previously theorized phenomena (23). Given the well-defined structure and clarity of Keller's four-component motivational model, guided content analysis provided a suitable framework for categorizing the identified principles and practical actions.

Results

Participants were recruited from various medical fields, including medicine (n = 18), nursing and midwifery (n = 15), health (n = 6), allied health (n = 4), and dentistry (n = 7). The sample consisted of 24 males and 26 females, with a mean age of 21.1 ± 2.35 years and a mean grade point average (GPA) of 17.51 ± 1.09.

In the first part of the study, 1175 initial codes and subsequently 185 sub-themes were identified. Through a process of conceptualization and synthesis, these sub-themes were further condensed into 81. Subsequent thematic analysis resulted in the identification of six main themes, forming the study's central concept: "The Narrow Alley of Talents." This main theme encompasses six distinct sub-categories. Table 2 provides a comprehensive overview of the identified main themes and their respective sub-themes. Talented students frequently experience a gradual erosion of their perceived distinctiveness, culminating in a sense of diminished differentiation between themselves and their peers.

Building upon the findings of the initial study, the second part of the study involved the development of a model, inspired by Keller's motivational theory, to mitigate the identified challenges and optimize the potential of talented students.

Table 3 presents the proposed model. The 'Theme' column delineates the key components of Keller's motivational model, while the 'Solution' column outlines the corresponding strategies and solutions. Strategies categorized under 'Attention' are specifically designed to sustain student motivation. These strategies are derived from the challenges that commonly lead to a decline in interest among talented students. Additionally, the 'Relevance' category underlines the crucial importance of connecting educational experiences to students' prior knowledge and experiences. These challenges stem from a perceived mismatch between the needs of talented students and the conventional teaching methods and resources offered by universities, culminating in a sense of disengagement and a questioning of the educational value proposition. Talented students frequently encounter barriers that impede their ability to fully express their abilities. A common complaint among these students is a lack of clear expectations, as their inability to effectively showcase their talents can significantly undermine their 'confidence'. The proposed 'satisfaction' strategies directly address these challenges by providing external rewards, opportunities for knowledge application, and fairness.

Discussion

A critical concern about talented students centers around the phenomenon of underachievement, where students with high potential fail to realize their full academic and personal potential (24). The success of talented students is intricately linked to a confluence of factors, including sustained motivation, an insatiable thirst for knowledge, and well-developed advanced learning skills (25). While a supportive educational environment is undeniably crucial (26), this study highlights the significant impact of inadequate university support and the presence of social challenges on the motivation of talented students. These factors can significantly impede their academic progress and overall well-being.

In this study, we developed a model aimed at enhancing the capabilities of talented students. The framework of this model is grounded in Keller's motivational model, which posits that student motivation is contingent upon a perceived sense of competence and an understanding of the value of the learning experience (27). Motivational design encompasses the allocation of resources and pedagogical approaches to influence and enhance student motivation (28). Keller's motivational model posits that student motivation can be effectively enhanced by fostering attention, relevance, confidence, and satisfaction (29, 30). Aligned with the objectives of this study, Clinkenbeard (2012) introduced the task, authority, recognition, grouping, evaluation, time (TARGET) model as a framework for structuring classroom environments to optimize the motivation of talented students. The primary objective of this model, consisting of six key variables (task, authority, recognition, grouping, evaluation, and time) is to foster students' development of mastery goals, thereby promoting sustained learning, heightened engagement with academic tasks, and a more integrated understanding across subject areas.

The TARGET model proposes that by offering tasks with desirable difficulty, and by fostering intrinsic motivation, educators can effectively support the learning of talented students. The model advocates for recognizing and rewarding student growth, learning, and mastery, and for adopting a criterion-based evaluation approach rather than a norm-based approach. Additionally, the model proposes tailoring time allotments and assignments to facilitate student achievement and mastery (24).

Subsequently, the proposed model is examined through the lens of Keller's motivational model. Each of the model's themes will be scrutinized individually:

Attention

Our findings indicate that while talented students exhibit high initial motivation, this level of motivation tends to diminish over time. This observation is consistent with the findings of Kanapathy et al.'s (2022) research, which demonstrated that although talented students possess inherent learning interests, sustained motivation is crucial for achieving optimal outcomes (31). In the context of cultivating and maintaining student engagement, a critical question arises: How can we not only generate initial interest but also ensure its sustained persistence? (32). It is argued that sustaining student interest is paramount, surpassing the mere act of initial attraction. One effective strategy for capturing and sustaining student attention is to incorporate diversity into the learning experience (32).

According to the expectancy-value theory, student motivation can be significantly enhanced by affording them the autonomy to select tasks aligned with their interests and perceived value (24). To effectively cater to the diverse talents and preferences of talented students, the proposed model emphasizes the importance of offering a wide range of programs and access to diverse facilities. Furthermore, employing engaging pedagogical approaches, actively encouraging student participation (32), and cultivating a climate of intellectual curiosity are crucial for optimizing learning outcomes for talented students (33). Drawing upon the self-determination theory (SDT), Almukhambetova and Torrano (2020) emphasized the profound influence of the learning environment and key social relationships on the motivation of talented students. Specifically, the study underscored the critical role of parents, peers, and teachers in either fostering or inhibiting intrinsic motivation within these students. These factors, in turn, exert a significant impact on their decision-making processes, adjustment, and ultimately, their overall academic achievement (5). Building upon this foundation, our model emphasizes the crucial role of continuous and meaningful interaction among students, professors, and educational administrators in stimulating the intellectual curiosity of talented healthcare students. Key strategies for achieving this include actively involving students in decision-making processes, establishing student committees, and ensuring that student perspectives are duly considered within the framework of national regulations and standards. Empowering students through active participation and embracing innovative pedagogical approaches are considered pivotal in cultivating a dynamic and intellectually enriching learning setting for such learners.

Relevance

To ensure relevance, the proposed model incorporates a multi-faceted approach that encompasses elucidating the benefits of talent membership, introducing students to the concept of talent, facilitating national networking events, and providing empowerment training for faculty members. Informed by interviews with talented students, these strategies align with the principle of relevance, which posits that education should connect to learners' prior knowledge and experiences. Previous research has identified a range of strategies for fostering connections, such as leveraging prior experiences, acknowledging present value, projecting future applications, providing exemplars, and making deliberate choices (32). Furthermore, the current study incorporates a variety of strategies including regular student interviews to assess their expectations, the development of specialized courses and workshops, personalized learning approaches, and the implementation of a research-based and contemporary educational framework tailored to the unique needs of talented students. Moreover, the model has been adapted and localized to suit specific contexts. To foster relevance, the model proposed a curriculum that clearly outlines future academic and professional pathways, coupled with comprehensive career counseling services. Aziz et al. (2021) underscore the critical role of collaborative understanding between parents, educators, and healthcare professionals in fostering the academic success of talented students (34). While acknowledging the importance of this multi-stakeholder approach, our model further emphasizes the pivotal role of student motivation in achieving academic excellence. The strategies aimed at enhancing relevance are consistent with the comprehension, elucidation, and systematic support of the needs of talented students, which can have a beneficial effect on their academic performance.

Confidence

To enhance confidence within the model, we delineated student expectations, fostered self-assurance, aligned student expectations with financial considerations, and established evaluation criteria for self-assessment. Additionally, we focused on assessing talented students, empowering experts, enhancing the quality of information, and instituting a mentorship framework. These strategies may serve to augment existing research on pedagogical approaches for these students. Siegle (2018) highlighted that while some talented students may underachieve in certain settings, they often demonstrate exceptional abilities when provided with supportive relationships and nurturing environments. Effective interventions are crucial to facilitate the optimal development of these students and to help them reach their full potential (35). To foster student confidence, it is essential to assess whether learners have a clear comprehension of the instructor's expectations and the specific requirements of the lesson. Moreover, it is crucial to gauge students' perceived likelihood of success (32). Student self-efficacy, defined as "positive expectations for success" (29), fosters a sense of self-assurance that can enhance the competencies of

health professions students. Ultimately, this contributes to improved healthcare quality (36). Clear goal setting and the provision of attainable examples foster the development of self-confidence. Attributing success to personal effort rather than external factors is crucial for boosting self-esteem (37). Talented students demonstrate a propensity for making positive causal attributions, often crediting their successes to abilities and diligent effort, while ascribing failures to external factors, such as misfortune. Equipping educators with the tools to foster such positive attributions can significantly enhance academic achievement and intrinsic motivation among these students (24). Additional strategies for enhancing confidence in the proposed model include evaluating the equilibrium between GPA requirements and students' abilities, aligning the complexity of educational content with students' levels of mastery, and providing advanced educational opportunities through extracurricular programs beyond the university setting. Optimal learning experiences necessitate a careful consideration of difficulty level. Educational challenges should be appropriately aligned with students' current skill levels to maintain engagement and motivation. Unrealistic or overly challenging tasks can lead to frustration and disengagement (29). Conversely, consistently providing students with more challenging problems fosters a sense of accomplishment and cultivates critical thinking and problem-solving skills. These skills have significant value beyond the academic domain (38). It is essential for students to recognize that their proficiency in various skills develops progressively over time in order to foster a sense of effectiveness. Talented students are likely to possess a strong academic self-concept and a high level of self-efficacy within their areas of talent (24). The proposed model incorporates a multifaceted approach, including peer-led learning, student research involvement, problem-solving skills, individual and group challenges, support for student initiatives, and collaborative learning environments. According to Lamanna, Vialle, and Wormald (2020), a combination of challenging yet appropriate curricula, tailored interventions, and strong teacher-student relationships are pivotal factors in fostering the academic success of talented students (39). It is essential to align the challenge level of tasks with the capabilities of students, as posited in the expectancy-value theory (24). The concepts of flow and mindset suggest that a student's intrinsic motivation is significantly affected by the congruence between their abilities and the challenges presented by the tasks. Furthermore, the SDT theory highlights the importance of autonomy, competence, and the necessity for social connections (24).

Satisfaction

The strategies for enhancing student satisfaction outlined in our model encompass a variety of initiatives, including the provision of rewards, the organization of leisure activities, the promotion of awareness regarding talented students, the equitable distribution of opportunities across all academic disciplines, the implementation of student-generated ideas, the standardization of facilities across universities, the acknowledgment of student achievements, the enhancement of professors' awareness, the strengthening of connections between universities and students' families, the emphasis on the added value of being part of a talented cohort, and the enhancement of students' self-esteem. According to Keller (2000), student motivation is contingent upon their awareness, interest, and appropriate levels of challenge. Satisfaction is characterized by positive sentiments regarding academic achievements and learning experiences. Factors contributing to satisfaction include tangible external rewards, opportunities for the application of knowledge, and a sense of justice and fairness (37). Additionally, addressing the individual needs of students significantly influences their overall satisfaction (29). Shakir and Mohd Ali (2021) underscored the necessity of establishing optimal systems to support talented students (40). An examination of the needs of talented healthcare students is essential for fostering their motivation and enhancing their capabilities. We advocate for other universities within our nation to investigate the challenges faced by these students and to provide the necessary support for their development.

Implications

The results of this research underscore the diverse experiences of talented students. By recognizing and addressing the unique needs of these students, educators can optimize their potential and maximize the return on investment in education. The study emphasizes the importance of considering motivational factors in addition to academic achievement.

-Given the model's provision of entirely objective and practical strategies, healthcare educators and educational administrators can implement these

approaches to sustain and augment the motivation of talented students.

-Furthermore, these strategies can serve as a foundation for establishing guidelines and policies specifically tailored to the needs of talented students.

-Moreover, these strategies can be employed to construct learning environments that are specifically designed to cater to the unique needs and abilities of talented students.

Limitations: A limitation of this study is its focus on undergraduate students, restricting the generalizability of the findings to other academic levels. Additionally, the sample may not be representative of talented students at other institutions.

Further Directions: This study, while employing purposive sampling and maximizing participant diversity among knowledgeable and experienced individuals, specifically focused on the experiences of Iranian students. To enhance the generalizability of these findings, future research should investigate the perspectives of talented students from diverse cultural backgrounds. Furthermore, future research should prioritize identifying and evaluating effective strategies for universities to enhance the motivation and academic success of talented healthcare students.

Conclusion

The effective identification, introduction, and support of talented students necessitate a collaborative effort across the universities. Educational administrators, faculty members, and fellow students all play crucial roles in this endeavor. The successful implementation of the strategies outlined in this research offers significant advantages. Neglecting the needs of talented students can have detrimental consequences, including a decline in their motivation, misallocation of financial resources, and potentially, an exodus of talent from the country, thereby impacting the future of the education and service sectors. Insufficient university support and the presence of social challenges can confine talented individuals to a "narrow alley of talents," hindering their full potential. Providing tailored educational opportunities, specialized services, and access to comprehensive consulting and external support systems can significantly enhance the abilities of talented students. The findings of this research offer valuable insights for students, educators, and educational administrators in effectively supporting and nurturing the talents of these exceptional individuals.

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References

1. Rinn AN, Plucker JA. High-ability college students and undergraduate honors programs: A systematic review. Journal for the Education of the Gifted. 2019;42(3):187-215. doi: 10.1177/0162353219855678.
2. García-Martínez I, Gutiérrez Cáceres R, Luque de La Rosa A, León SP. Analysing educational interventions with gifted students. Systematic Review. Children (Basel). 2021 May 3;8(5):365. doi: 10.3390/children8050365. [PMID: 34063631] [PMCID: PMC8147618]
3. Alexopoulou A, Batsou A, Drigas A. Resilience and Academic Underachievement in Gifted Students: Causes, Consequences and Strategic Methods of Prevention and Intervention. International Journal of Online & Biomedical Engineering. 2019;15(14): 79. doi: 10.3991/ijoe.v15i14.11251.
4. Wiley KR. The social and emotional world of gifted students: Moving beyond the label. Psychology in the Schools. 2020;57(10):1528-41. doi: 10.1002/pits.22340.
5. Almukhambetova A, Hernández-Torrano D. Gifted students' adjustment and underachievement in university: An exploration from the self-determination theory perspective. Gifted Child Quarterly. 2020;64(2):117-31. doi: 10.1177/0016986220905525.
6. Mammadov S, Cross TL, Olszewski-Kubilius P. A look beyond aptitude: The relationship between personality traits, autonomous motivation, and academic achievement in gifted students. Roeper Review. 2021;43(3):161-72. doi: 10.1080/02783193.2021.1923595.
7. Hornstra L, Bakx A, Mathijssen S, Denissen JJ. Motivating gifted and non-gifted students in regular primary schools: A self-determination perspective. Learning and Individual Differences. 2020;80:101871. doi: 10.1016/j.lindif.2020.101871.
8. Desmet OA, Pereira N. The achievement motivation enhancement curriculum: Evaluating an affective intervention for gifted students. Journal of Advanced Academics. 2022;33(1):129-53. doi: 10.1177/1932202X211057424.
9. Goksu I, Islam Bolat Y. Does the ARCS motivational model affect students' achievement and motivation? A meta-analysis. Review of Education. 2021;9(1):27-52. doi: 10.1002/rev3.3231.
10. Zubaedi Z, Alfauzan A, Asiyah A, Suhirman S, Alimni A, Amaliyah A, et al. Learning style and motivation: gifted young students in meaningful learning. Journal for the Education of Gifted Young Scientists. 2021;9(1):57-66. doi: 10.17478/jegys.817277.

11. Suherman S, Zaman AM, Farida F. Fostering of mathematical critical thinking ability using ARCS model and students' motivation. JTAM (Jurnal Teori Dan Aplikasi Matematika). 2021;5(1):134-43. doi: 10.31764/jtam.v5i1.3798.
12. Afjar A, Syukri M. Attention, relevance, confidence, satisfaction (ARCS) model on students' motivation and learning outcomes in learning physics. J Phys: Conf Ser. 2020; 1460(1): 1-6. doi: 10.1088/1742-6596/1460/1/012119.
13. Daugherty KK. ARCS motivation model application in a pharmacy elective. Curr Pharm Teach Learn. 2019 Dec;11(12):1274-1280. doi: 10.1016/j.cptl.2019.09.009. [PMID: 31836153]
14. Ma L, Lee CS. Evaluating the effectiveness of blended learning using the ARCS model. Journal of computer assisted learning. 2021;37(5):1397-408. doi: 10.1111/jcal.12579.
15. Ucar H, Kumtepe AT. Effects of the ARCS-V-based motivational strategies on online learners' academic performance, motivation, volition, and course interest. Journal of Computer Assisted Learning. 2020;36(3):335-49. doi: 10.1111/jcal.12404.
16. Dinçer S. The effects of materials based on ARCS Model on motivation: A meta-analysis. Ilkogretim Online. 2020;19(2): 1016-42. doi: 10.17051/ilkonline.2020.695847.
17. Wijsman LA, Saab N, Schuitema J, van Driel JH, Westenberg PM. Promoting performance and motivation through a combination of intrinsic motivation stimulation and an extrinsic incentive. Learning Environments Research. 2019; 22: 65-81. doi: 10.1007/s10984-018-9267-z.
18. Burns EC, Martin AJ. Motivational Issues in Gifted Education: Understanding the Role of Students' Attribution and Control Beliefs, Self-Worth Protection and Growth Orientation. In: Smith SR. (eds) Handbook of Giftedness and Talent Development in the Asia-Pacific. Springer International Handbooks of Education. Singapore: Springer; 339-57. doi: 10.1007/978-981-13-3041-4_15.
19. Keshavarz H. Hermeneutic phenomenology in supporting research and information services: contributions to information science. Journal of Information Science Theory and Practice. 2020;8(4):29-39.
20. Ozanne JL. Book Review: Basics of Qualitative Research. Los Angeles, CA: Sage publications Sage CA; 1992: 382-4. doi: 10.1177/002224379202900312.
21. Morrow R, Rodriguez A, King N. Colaizzi's descriptive phenomenological method. The psychologist. 2015;28(8):643-4.
22. Keller JM. Development and use of the ARCS model of instructional design. Journal of instructional development. 1987;10(3):2-10. doi: 10.1007/BF02905780.
23. Kibiswa NK. Directed Qualitative Content Analysis (DQlCA): A Tool for Conflict Analysis. The Qualitative Report. 2019; 24(8): 2059-79. doi: 10.46743/2160-3715/2019.3778.
24. Clinkenbeard PR. Motivation and gifted students: Implications of theory and research. Psychology in the Schools. 2012;49(7):622-30. doi: 10.1002/pits.21628.
25. Alelyani SO. Special Educational Need of the Gifted and Talented Students in Saudi Arabia: A Review Paper. International Journal of Educational Research Review. 2021;6(2):124-33. doi: 10.24331/ijere.854926.
26. Abbaspour H, Karimi Moonaghi H, Kareshki H, Esmaeili H. The consequences of hidden curriculum for nursing professionalism: A qualitative study. Journal of Qualitative Research in Health Sciences. 2023;12(2):100-6. doi: 10.34172/jqr.2023.15.
27. Hodges CB. Designing to motivate: Motivational techniques to incorporate in e-learning experiences. The Journal of Interactive Online Learning. 2004;2(3):1-7.
28. Fardanesh H, Ebrahimzade I, Sarmadi M, Rezaie M, Omrani S. A Comparative Study of Learning and Motivation in Continuing Medical Education Based on Integrated Instructional and Motivational Design Models. Iran J Med Educ. 2012; 12 (5): 364-76. [In Persian]
29. Liao HC, Wang Y. Applying the ARCS motivation model in technological and vocational education. Contemporary Issues in Education Research. 2008;1(2):53-8.
30. Karimi Moonaghi H, Zhianifard A. Instructional Design in Medical Sciences. 2nd ed. Mashhad: Mashhad University of Medical Sciences; 2021. [In Persian].
31. Kanapathy S, Binti Hamuzan HA, Menon P, Woon YH. Gifted and Talented Students "Underachievement" and Intervention: A Case Study. European Journal of Education and Pedagogy. 2022; 3(5): 114-22. doi: 10.24018/ejedu.2022.3.5.453.
32. Kanaani M, Eskandari A. Implementing Curriculum With Keller's motivational Educational pattern. Monthly Journal of Educational Technology (Growth). 2013;28(3): 12-4. [In Persian].
33. Soltani Arabshahi SK, Bigdeli Sh, Kouhpayezade J, Jafarpour A. Designing a Reliable and Valid Instrument to Determine the Effective Motivational Factors on Medical Students Learning Based on Keller's ARCS Model. Educ Strategy Med Sci. 2014; 6(4): 241-6. [In Persian]
34. Aziz ARA, Ab Razak NH, Sawai RP, Kasmani MF, Amat MI, Shafie AAH. Exploration of challenges among gifted and talented children. Malaysian Journal of Social Sciences and Humanities. 2021;6(4):242-51.
35. Siegle D. Understanding Underachievement. In: Pfeiffer S. (eds) Handbook of Giftedness in Children. 2nd ed. Cham: Springer; 2022: 285-97. doi: 10.1007/978-3-319-77004-8_16.
36. Abbaspour H, Karimi Moonaghi H, Kareshki H, Esmaeili H. Positive consequences of the hidden curriculum in undergraduate nursing education: An integrative review. Iran J Nurs Midwifery Res. 2022 May 23;27(3):169-80. doi: 10.4103/ijnmr.ijnmr_325_21. [PMID: 36237954] [PMCID: PMC9552589]
37. Keller JM. How to integrate learner motivation planning into lesson planning: The ARCS model approach. Santiago, Cuba: VII Semanario; 2000: 13.
38. Toussaint MJ, Brown V. Connecting the arcs motivational model to game design for mathematics learning. Transformations. 2018; 4(1): 19-28.
39. Lamanna J, Vialle W, Wormald C. Reversing underachievement in students with twice-exceptionality: Findings from two case studies. TalentEd. 2020;32(1):1-22.
40. Shakir SA, Ali MABM. Gifted education in Malaysia: A promising tomorrow. Vietnam Journal of Educational Sciences. 2021; 17(1): 75.

Table 2. Main theme, sub-themes, and examples

Main Theme	Sub-Themes	Examples
Narrow alley of talents	Motivational slope	"At first, I was excited, but over time, it became a routine for me. I came to understand that being talented is not something special, that is, I was discouraged." "These facilities and benefits are not appropriate for talented students."
	Striving for improvement	"For instance, as I mentioned earlier, talented students can achieve double straight as with fewer conditions. In my opinion, to be straight, a student must score below 2.5%, and a talented student scoring below this threshold should be recognized with double straight. The percentage requirement for talented students should be adjusted to 4% instead of 2.5%."
	Uneven university path	"An important point to note is that there is limited information regarding the resources available to talented students at the university, resulting in a lack of sufficient information for everyone." "Education should be of the highest quality. The books available to me, the resources provided by my professors, and the projects assigned to me should all align with my needs."
	Social lens	"From a social perspective, many people view talent as a valuable and positive attribute. " "Society hindered me from pursuing my desires instead of encouraging me to follow that path." - "Dissatisfaction with other classmates."
	Family umbrellas	"If the support from my family does not align with my motivation, and if they fail to provide constructive feedback, I may feel very depressed. This situation can significantly impact my academic performance and overall progress." "As a student, being away from my family has been challenging for me. Throughout my school years, I studied alongside my family in the comfort of my own room and at my personal study table. Transitioning to a crowded dormitory environment proved difficult, as I was accustomed to studying in a quieter setting. This change hindered my ability to focus and perform well academically. It took me a considerable amount of time to adjust to this new situation."
	The bright side of talents	"It generates a constructive form of stress that encourages you to work diligently and study well to maintain a high average. This represents a beneficial challenge." "...Because of this, my situation was more favorable than that of others. During the first and second semesters, I experienced both competition and pride. In my group, almost no one else was direct, which proved to be a unique and advantageous quality for me."

Table 3. The model for improving the capabilities of talented students based on Keller's motivational model

Theme	Solution
Attention	To attract the attention of talented students, the following strategies are recommended: 1. Offering resources and opportunities for talented students tailored to their individual preferences. 2. Establishing continuous interaction among students, professors, and educational administrators. 3. Engaging students in educational, research, and sociocultural decision-making. 4. Forming committees composed of outstanding students across various levels. 5. Providing information to students both individually and in groups. 6. Providing rewards on special occasions. 7. Considering the opinions of talented students regarding facilities and benefits. 8. Engaging talented students in empowering others. 9. Informing professors about talented students and providing feedback. 10. Implementing a variety of programs to engage and attract students. 11. Considering students' interests in conjunction with their field of study. 12. Employing engaging methods such as educational technologies (e.g., games and mobile learning). 13. Implementing an innovative and humanistic approach in education.
Relevance	To maintain its relevance and sustainability in attracting talented students, the following strategies are recommended: 1. Recognizing the diminishing initial value and appeal of talent over time, and considering the significance of this from the students' perspective and their learning preferences. 2. Conducting interviews and surveys to gain insights into students' expectations and experiences, while effectively communicating the benefits of being part of a talented community. 3. Offering elective courses that align with the interests of talented students. 4. Offering specialized talent development workshops 5. Organizing nationwide events to showcase talented students and promote networking and collaboration. 6. Offering extracurricular courses in subjects outside the standard curriculum. 7. Providing a comprehensive introduction to talented students, ensuring they are aware of all aspects of membership. 8. Implementing research-based and contemporary educational approaches, and adapting appropriate educational models to meet their specific needs. 9. Conducting empowerment courses for professors focused on nurturing talented students. 10. Customizing education for talented students. 11. Providing a clear vision for talented students and their future. 12. Establishing a counseling system for educational and career guidance. 13. Organizing and hosting nationwide events to promote student collaboration and facilitate the exchange of experiences.
Confidence	To enhance the confidence of talented students, the following strategies are recommended: 1. Enhancing education by involving talented students in the teaching process. 2. Teaching research skills and involving students in research topics. 3. Balancing salary expectations while avoiding psychological and work-related pressure. 4. Balancing GPA requirements with students' academic levels. 5. Establishing a mentorship system. 6. Regularly reviewing regulations for talent based on available evidence. 7. Enhancing education through problem-solving skills and individual/group challenges. 8. Supporting the ideas and plans of talented students. 9. Developing an evaluation system for talented students. 10. Providing evaluation criteria to assist students in assessing their likelihood of success. 11. Offering courses in learning psychology to enhance self-confidence. 12. Providing group study environments for talented students. 13. Tailoring educational content to align with the mastery levels of talented students and gradually increasing complexity over time. 14. Defining expectations and create learning opportunities for talented students. 15. Teaching advanced content through external programs. 16. Empowering staff members. 17. Enhancing the quality and quantity of notifications. 18. Creating visibility mechanisms for talented students.
Satisfaction	To enhance the satisfaction of talented students, the following strategies are recommended: 1. Offering incentives to motivate students and prevent demotivation. 2. Planning recreational activities to alleviate cognitive load.

	3. Organizing events to raise awareness of talented individuals. 4. Ensuring equal opportunities for students across various majors. 5. Addressing the requests of talented students for facilities and benefits in accordance with national regulations and standards. 6. Implementing students' knowledge and ideas beyond merely obtaining a degree. 7. Ensuring equal opportunities for talented students across all universities. 8. Acknowledging and supporting talented students. 9. Increasing professors' awareness of talented students. 10. Strengthening the connection between universities and the families of exceptional students. 11. Enhancing students' self-esteem. 12. Organizing various student competitions. 13. Recognizing the added value of being a talented student.

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Letter to editor

Enhancing Medical Education: Learning Engineering and Technologies for Training Future Healthcare Professionals

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Keywords: Learning Engineering; Learning Technology; Medical Education

Dear Editor,

The contemporary healthcare landscape necessitates the integration of learning engineering and advanced technologies into medical education to adequately prepare future healthcare professionals. This modernization is crucial to ensure that graduates possess the competencies required to navigate the complexities of the modern healthcare system. Innovative pedagogical approaches, including adaptive learning platforms and simulation-based training, are transforming the dissemination of medical knowledge. These approaches offer personalized learning experiences, thereby enhancing both student engagement and knowledge retention. Furthermore, the incorporation of virtual reality, artificial intelligence, and data analytics improves the authenticity of clinical training experiences, fostering the development of critical thinking and decision-making skills indispensable for modern medical practice. By effectively blending traditional instructional methods with advanced technologies, medical education can ensure that graduates possess a comprehensive understanding of medical principles and are proficient in navigating the digital healthcare ecosystem. This integration ultimately contributes to improved patient care and superior clinical outcomes (1).

Learning engineering constitutes a multidisciplinary field that amalgamates principles from education, cognitive science, engineering, and data analytics. Its primary objective is to conceptualize, develop, and refine educational experiences and environments. Approaches such as learning analytics, educational data mining, and design-based research serve to enhance learning outcomes and provide a robust framework for optimizing educational practices (2). Dede et al. underscore the imperative of employing evidence-based strategies to facilitate the continuous design and redesign of learner experiences (3). Baker emphasizes that learning engineering seeks to optimize educational practices and technologies through the application of systematic methods during active implementation. This approach prioritizes the customization of programs to cater to the diverse learning needs of individual learners (2). By leveraging learning data, learning engineers are empowered to create personalized learning programs, utilize adaptive technologies, and optimize curricula. The overarching aim is to employ evidence-based methodologies and innovative strategies to enhance the efficacy of education and training across diverse settings, including healthcare professional schools and professional development programs. This approach is deeply grounded in the principles of learning science, educational technology, and data science (2).

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The education of healthcare professionals aims to inculcate in individuals the knowledge, skills, and ethical principles required for competent professional practice. This educational journey spans undergraduate training, postgraduate education, and continuous professional development. To remain at the forefront of medical progress, these educational programs necessitate ongoing adaptation in response to advancements in medical science and technology. The overarching objective is to equip future healthcare professionals with the necessary competencies to deliver high-quality patient care (4). Concurrently, as healthcare professions education undergoes transformative changes in response to rapid technological advancements, the integration of learning engineering principles emerges as a valuable paradigm for optimizing teaching methodologies and learning outcomes. The incorporation of these principles fosters greater adaptability and enhances the effectiveness of training programs. Recognizing the inherent complexity of contemporary healthcare, the adoption of innovative pedagogical approaches is imperative. Collaborative endeavors between engineering and medical education facilitate the generation of creative solutions to the multifaceted challenges encountered in contemporary healthcare. The application of engineering principles empowers educators to design curricula that effectively prepare students to assume interdisciplinary roles within the evolving healthcare landscape (5).

This educational model emphasizes the acquisition of robust clinical competencies alongside the cultivation of strong analytical and problem-solving skills, essential for navigating the complexities of contemporary medical practice. A synergistic partnership between learning engineering and medical education is paramount to adequately prepare healthcare professionals to effectively meet the dynamic and evolving demands of patient care within a technologically advanced healthcare system. This collaboration facilitates the development of an education framework that is both effective and contemporary, aligning seamlessly with the evolving needs of modern healthcare.

In conclusion, the successful integration of learning engineering principles and cutting-edge technologies into the medical education curriculum is indispensable for cultivating a new generation of healthcare professionals equipped to excel in the multifaceted and intricate landscape of modern patient care. The adoption of innovative pedagogical approaches not only enhances learning outcomes but also equips graduates with the necessary skills and knowledge to thrive within a technologically driven healthcare landscape.

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References

1. Leiphrakpam PD, Armijo PR, Are C. Incorporation of Simulation in Graduate Medical Education: Historical Perspectives, Current Status, and Future Directions. J Med Educ Curric Dev. 2024 May 26:11:23821205241257329. doi: 10.1177/23821205241257329. [PMID: 38808125] [PMCID: PMC11131395]
2. Baker RS, Boser U, Snow EL. Learning Engineering: A View on Where the Field Is at, Where It's Going, and the Research Needed. Technology, Mind, and Behavior. 2022; 3(1). doi: 10.1037/tmb0000058.
3. Dede C, Richards J, Saxberg B. Learning engineering for online education. New York, USA: Routledge; 2019. doi: 10.4324/9781351186193.
4. Abd-Alrazaq A, AlSaad R, Alhuwail D, Ahmed A, Healy PM, Latifi S, et al. Large language models in medical education: opportunities, challenges, and future directions. JMIR Med Educ. 2023 Jun 1:9:e48291. doi: 10.2196/48291. [PMID: 37261894] [PMCID: PMC10273039]
5. Rambukwella M, Balamurugan A, Klapholz H, Beninger P. The Application of Engineering Principles and Practices to Medical Education: Preparing the Next Generation of Physicians. Med Sci Educ. 2021 Jan 21;31(2):897-904. doi: 10.1007/s40670-021-01217-x. [PMID: 33495720] [PMCID: PMC7817250]

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Original Article

Comparison of the Flipped Classroom Versus Demonstration Education Method on Nasogastric Tube Insertion Practical Skill of Nursing Students

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Abstract

Background: The education of medical sciences requires a fundamental change to improve clinical decision-making capacities by using new teaching methods.

Objectives: The present study aimed to compare the effect of the Flipped classroom (FC) with demonstration education (DE) in the practical skill of nasogastric tube (NGT) insertion.

Methods: The present interventional study was conducted in a faculty of nursing for two sequence semesters. Nursing students were selected by census sampling method and then randomly allocated to two groups, FC (19 and 17 participants) and DE (18 and 19 participants). In the DE method group, the NGT insertion was explained to the nursing students in the skill laboratory. Then, in the FC group method, a week ago, the video and the written educational content related to the NGT insertion procedure were provided to the nursing students. In both groups, two sessions were provided for the nursing students to practice the NGT insertion procedure independently on the Moulage. A comparison of the practical skill and satisfaction scores was done one week after intervention in both groups. The descriptive statistics, chi-square, Fisher exact test, and Mann Whitney u test were applied using the SPSS software, version 24. A P-value less than 0.05 was considered statistically significant.

Results: The results of the statistical tests showed a non-significant difference between the two groups in terms of age, mean diploma score, gender, marital status, native status, and living in a dormitory. In the first semester, the practical skill score was non-significantly higher in the FC group [FC: 70.00 ± 2.16 vs. DE: 68.94 ±1.62, p=0.105], but in the second semester, it was significant in the FC group [FC: 67.70 ± 5.65) vs. DE: 61.00 ± 7.64, p=0.005]. The nursing students in the FC group had significantly higher satisfaction compared to the DE group in both semesters [FC: 99.44 ±1.61 vs. DE: 93.10 ±4.70, p<0.001 and FC: 94.11 ± 6.18 vs. DE: 86.15 ± 6.31, p=0.001, respectively).

Conclusion: This study showed FC method can be used as a satisfactory and effective teaching approach in NGT insertion. So, it is recommended that educational managers consider it because of the high satisfaction of nursing students in clinical teaching.

Keywords: Nursing; Professional Practice; Teaching; Clinical Competence; Students; Education; Enteral Nutrition

Background

Most nursing students' learning process occurs in a clinical setting. So, clinical education is considered the main basis of nursing education (1). The study's finding on Iranian nursing students showed a very poor self-evaluation of pharmaceutical care skills. So, more than 65% of students reported insufficient skills (2). Most nursing education programs use the demonstration education (DE) method in which the teacher transfers knowledge to the students. Passive involvement in

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information processing and lack of development of the necessary insight into the transient process and knowledge of clinical setting are the main limitations of the DE method (3). The education of medical sciences, including nursing, requires a principal change to improve clinical decision-making capacities by using new teaching methods and strengthening student-centered learning (4). One of the growing and technology-based educational methods is the flipped classroom (FC) approach (5). Despite the DE method, in the FC approach, the learners watch videos of recorded lectures before class, do their studies and assignments before class, present in the classroom readily, and participate cooperatively including group discussions and case studies (6). The results of a study in South Korea showed the FC method was a useful approach to self-directed learning ability and willingness to critical thinking of nursing students during fundamental nursing courses (7). Also, an Iranian study revealed the positive effects of FC compared to the DE method on the knowledge of using medical equipment (infusion pump, monitoring, and electroshock) in senior nursing students (8).

Another study in South Korea, which was conducted on second-year undergraduate nursing students, showed that the FC method can be used as an effective educational program to improve students' self-efficacy, critical thinking, and communication competence (9). Also, an Iranian study on dental students revealed the FC method could improve and satisfy dental students in the periodontal and pediatric per clinical courses (10). Another Iranian study on medical students in the course of physiopathology showed the FC method can be useful (11). A Chinese study showed that the FC teaching method is an effective approach for ophthalmology students without clinical experience (12). Another Chinese study reported that the FC was an effective method in teaching bag-mask ventilation and intravenous cannulation as a clinical skill teaching approach among medical students (13).

Objectives

According to the literature review and considering the lack of comparison study between the FC and DE in the nursing fundamental course in Iran, the present study aimed to compare the effect of the FC with DE in the practical skill of nasogastric tube (NGT) insertion.

Methods

Study Design and Sampling: The present posttest interventional study was conducted in a faculty of nursing affiliated with Mazandaran University of Medical Sciences, Sari, Iran, for two sequence semesters on nursing students who were accepted in the same university entrance exam in 2022, including the 2nd 2021-2022 semester and the 1st 2022-2023 semester. The nursing students were selected by census sampling method. So that a list of students (in coded form) was prepared from the nursing faculty education unit, and then they were randomly assigned to two groups, FC (19 and 17 participants) and DE (18 and 19 participants) method, according to the random numbers table. To ensure the adequacy of the sample size, after conducting the study and calculating the effect size based on G power software with a sample size of 34 participants and $\alpha=0.05$, the power of the study was calculated to be 0.90, which is acceptable. The inclusion criteria consisted of 1st-semester nursing students who were eligible for the nursing fundamental course and willing to participate. Unlicensed assistive personnel and nursing students who participated in the course again were excluded.

Data Collection Tools: The data collection tools were demographic, practical skill, and satisfaction questionnaire. The demographic questionnaire consisted of age, mean diploma score, gender, marital status, native status, and living in a dormitory. In the present study, native status was defined as being born in Mazandaran province. The socio-demographic questionnaire had been completed before the intervention.

The 36-item practical skill checklist was developed by researchers based on the two valid nursing fundamental textbooks (14, 15) and scored on a 3-point Likert scale (0=Failure to perform the procedure correctly, 1= incompletely performing the procedure and 2= Perform the procedure correctly, and completely). The qualitative content validity of educational content and also practical skill checklist were assessed by five nursing faculty members. The reliability of the practical skill checklist was calculated at 0.82 using Intra Class Correlation (ICC) by 2 independent evaluators. Also, the practical skill checklist had validity (14, 15).

Nursing students were asked to rate their satisfaction with the educational method from 0 (very dissatisfied) to 100 (very satisfied) using the Visual Analogue Scale (VAS). This scale is used to assess satisfaction (16). VAS was used in other studies to assess the level of student satisfaction (17). The validity of VAS was assessed in Adib Haj Bagheri 's study on nursing students (18).

The practical skill checklist and VAS had been completed by an evaluator who had not been a teacher of nursing students in the skill laboratory one week after intervention in both groups. So that the evaluator gives

a grade to the student according to the checklist after asking the questions based on the different steps of the procedure.

Educational Method: In the DE method group, the NGT insertion was explained to the skill laboratory nursing students, and the teacher answered their questions. In two sessions during the next week (from 8:00 am to 2:00 pm), the nursing students independently practiced the NGT insertion procedure in the skill laboratory on the Moulage of NGT.

Then, in the FC method, learning objectives were identified a week ago, and pre-class material, including the video and the written educational content related to the NGT insertion procedure, were provided to the nursing students by the same teacher as the DE method group. Also, the teacher organized pre-class activities. One week later, a teacher planned the in-class activity and the NGT insertion procedure, which was explained by a teacher with the collaboration of the students in the skill laboratory. To assess the learning, the teacher involved the students. They asked questions, answered, and discussed the procedure.

On the other hand, the procedure was taught using the cooperative teaching method. The step was educational support. Similar to the DE group, in two sessions during the next week (from 8:00 am to 2:00 pm), the nursing students independently practiced the NGT insertion procedure in the skill laboratory on the Moulage of NGT (19).

Data analysis: Statistical analyses were performed using the SPSS software, version 24. Also, descriptive statistics were used to describe the data, including frequency, percentage, mean and standard deviation. The result of the Kolmogorov Smirnov test showed data were abnormal so the non-parametric tests were used. The chi-square and Fisher exact test were used to compare the two groups regarding gender, marital status, native status, and living in the dormitory. Mann-Whitney u test was used to compare the two groups in terms of age, diploma score, practical skill score, and satisfaction. A P-value less than 0.05 was considered statistically significant.

Results

The result of the Kolmogorov Smirnov test is presented as follows: The 2nd 2021-2022 semester: *p*-value: 0.049 for satisfaction and *p*-value<0.001 for the rest of variables & the 1st 2022-2023 semester: *p*-value=0.036 for practical skill, *p*-value=0.003 for diploma score and *p*-value<0.001 for the rest of variables.

Results of the 2nd 2021-2022 Semester

Table 1 shows a comparison of the socio-demographic characteristics of nursing students in the FC vs. DE method groups. The results of the Mann Whitney u test showed there was a non-significant difference between the two groups in terms of age [FC: 19.78± 0.71 vs. TE: 19.94±1.05, P=0.580] and mean of diploma score (FC: 18.85±0.66 vs. TE: 18.73±0.99, P=0.831].

Table 1. Comparison of the socio-demographic characteristics of nursing students in the FC vs. DE method groups

Variable	2nd 2021-2022 semester			1st 2022-2023 semester		
	Group		P-value	Group		P-value
	FC (N=19)	DE (N=18)		FC(N=17)	DE (N=19)	
Gender, n (%)			0.515*			0.736*
Female	10 (52.6)	7 (38.9)		8 (47.1)	7(36.8)	
Male	9 (47.4)	11 (61.1)		9 (52.9)	12 (63.2)	
Marital status, n (%)			1.000**			1.000**
Single	19 (100)	18 (100)		17(100)	18(94.7)	
Married	0 (0.0)	0 (0.0)		0 (0.0)	1(5.3)	
Native status, n (%)			0.230**			0.721*
Yes	16 (84.2)	18 (100)		6(35.3)	5(26.3)	
No	3 (15.8)	0 (0.0)		11(64.7)	14(73.7)	
Living in dormitory, n (%)			1.000**			0.316*
Yes	1 (5.3)	0 (0.0)		10(58.8)	12(63.2)	
No	18 (94.7)	18 (100)		7(41.2)	7(36.8)	
Age (Year), Mean (SD)	19.78 (0.71)	19.94(1.05)	0.580***	19.35 (1.05)	19.42 (1.01)	1.000***
Diploma score, Mean (SD)	18.85(0.66)	18.73(0.99)	0.831***	19.17 (0.41)	19.21 (0.22)	0.802***

*Chi-square, **Fisher exact test, ***Mann Whitney u test

Table 2. Comparison of the practical skill and satisfaction in the FC vs. TE method

Variable	Score range of scale	2nd 2021-2022 semester			1st 2022-2023 semester		
		Group		P-value	Group		P-value
		FC Mean (SD)	DE Mean (SD)		FC Mean (SD)	DE Mean (SD)	
Practical skill	0-72	70.00 (2.16)	68.94 (1.62)	0.105*	67.70 (5.65)	61.00 (7.64)	0.005*
Satisfaction	0-100	99.44 (1.61)	93.10 (4.70)	<0.001*	94.11 (6.18)	86.15 (6.31)	0.001*

*Mann Whitney u test

Most nursing students were females in the FC group (52.6%) and males in the DE group (61.1%). However, the statistical test showed this difference was not significant between the two groups (P=0.515). All of the nursing students were single in two groups.

Although the mean ±SD of the practical skill score was higher in the FC group, the statistical test showed this difference was non-significant [FC: 70.00±2.16 vs. DE: 68.94±1.62, P=0.105]. However, the nursing students in the FC group had significantly higher satisfaction compared to the DE group [FC: 99.44±1.61 vs. DE: 93.10±4.70, P<0.001] (Table 2).

Also, the results indicated that the FC method had a medium effect size compared to the DE method regarding practical skill score (d=0.553).

Results of the 1st 2022-2023 Semester

The results of the Mann Whitney u test showed there was a non-significant difference between the two groups in terms of age [FC: 19.35±1.05 vs. TE: 19.42±1.01, P=1.000] and mean of diploma score (FC: 19.17±0.41 vs. TE: 19.21±0.22, P=0.802]. Most nursing students were males [FC: 52.9% vs. TE: 63.2%, P=0.736] and single in both groups (FC: 100% vs. DE: 94.7%, P=1.000). The statistical test revealed a non-significant difference between the two groups (Table 1).

Despite the previous semester, the mean ±SD of the practical skill score was significantly higher in the FC group [FC: 67.70 ±5.65 vs. TE: 61.00 ±7.64, P=0.005]. Also, the nursing students in the FC group had significantly higher satisfaction than the TE group [FC: 94.11±6.18 vs. DE: 86.15 ±6.31, P=0.001] (Table 2).

Also, the results indicated that the FC method had a larger effect size than the DE method in terms of practical skill score (d=0.989).

Discussion

The main purpose of the present study was to compare the effects of two educational methods, FE and DE methods, on the practical skill and satisfaction of nursing students. The results of the present study showed the nursing students in the FC group had higher practical skills and satisfaction than the DE group. A quasi-experimental study was conducted on Omani nursing students to assess the effect of FC on performance and satisfaction in respiratory system items in anatomy and physiology courses. The results showed the mean score of students who underwent FC educational method had a higher final examination score than the traditional lecture group (20). Also, the study's finding in Cyprus showed FC method had significant positive effects on venous thromboembolism course learning among nursing students (21). The finding of a Spanish study showed FC method vs. face-to-face learning method positively affected attitude, skills, and global competence using evidence-based practice in undergraduate nursing students (22). In the FC method, the students are motivated due to the students-centered learning environment and self-control to develop the learning skills (23).

The results of a quasi-experimental study on Iranian postgraduate students in the Faculty of Medicine showed that the psychological empowerment scores increased after intervention for the two groups. However, the mean post-test score was higher in team-based learning than in the FC group (24). However, the results of a Chinese quasi-experimental study on nursing students revealed that the FC method developed critical thinking, self-cognition, and evaluation abilities of nursing students in the community nursing course. But, the satisfaction score was not statistically different (25).

The difference may be due to the dependent variable of the Chinese and our study. In the current study, the dependent variable had a practical nature. Also this satisfaction could be due to the novelty of the teaching method that participants did not experience so far. Also, humans tend to actively engage in exposure to a novel technology (26). A Chinese explanatory mixed-methods study was performed on nursing students' psychomotor skill instruction showed the FC method was more suitable for active students. Also, the passive students had significantly higher stress perception and lower satisfaction than the active nursing students (27). But in

the present study, the mean score of satisfaction and practical skill was higher in the FC group. The results of a study on Chinese nursing students revealed the combination of FC and workshop is effective in developing nurse's active learning abilities and clinical thinking (28). The primary factors contributing to high satisfaction in the FC method may include the model's provision of active learning opportunities, efficient utilization of classroom time, the facilitation of self-paced learning, and the ability for students to access videos at their convenience, regardless of location (29).

The finding of a mixed-method study on third-year nursing students showed improving independent learning, enhancing peer learning, and increasing teacher–student interaction were the main outcomes of the Audio-Visual FC in maternal nursing laboratory course (30). The results of an Iranian study revealed that the online FC method had a significant effect on metacognitive awareness and self-directed readiness improvement (31). It seems that self-directed readiness is the prerequisite of the FC method and faculty teachers should consider this concept to achieve the optimal learning outcome. On the other hand, active responsibility in the learning process is the FC approach's main characteristics (32). The outcomes of an exploratory qualitative research on Sri Lankan nursing teachers showed their perception of FC readiness. The teachers believed educational technology, acceptability of the FC pedagogy, and the educational environment are the main prerequisites of readiness (33). So, the teachers should consider it in designing FC approaches.

The limitation of the present study was allocating the nursing students of one class to two groups, and the small sample size might obscure the real effect of the FC method compared to the DE method. So, we conducted the study for two sequence semesters. In addition, we use the FC method for only one type of practical skill for nursing students. Also, the evaluation had been done for a short period and is suggested to evaluate the long-term outcomes of the FC method in clinical teaching.

Conclusion

This study showed FC method can be used as a satisfactory and effective teaching approach in NGT insertion. So, it is recommended that educational managers consider it because of the high satisfaction of nursing students in clinical teaching.

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References

1. McCutcheon K, Lohan M, Traynor M, Martin D. A systematic review evaluating the impact of online or blended learning vs. face-to-face learning of clinical skills in undergraduate nurse education. J Adv Nurs. 2015 Feb;71(2):255-70. doi: 10.1111/jan.12509. [PMID: 25134985]
2. Zareie F, Baaghi P, Ghaderian K, Shams S, Naseri O. The study on student's self-assessment of pharmaceutical-care skills in nursing students, Urmia University of Medical Sciences. Nursing and Midwifery Journal. 2014; 12(7): 544-51. [In Persian]
3. Dehghanzadeh S, Alizadeh S. Explaining Nursing Students' Experiences of a Flipped Classroom. Journal of Medical Education Development. 2018;11(31):1-15. doi: 10.29252/edcj.11.31.1.
4. Gilboy MB, Heinerichs S, Pazzaglia G. Enhancing student engagement using the flipped classroom. J Nutr Educ Behav. 2015 Jan-Feb;47(1):109-14. doi: 10.1016/j.jneb.2014.08.008. [PMID: 25262529]
5. Benner P. Educating nurses: A call for radical transformation—how far have we come? J Nurs Educ. 2012 Apr;51(4):183-4. doi: 10.3928/01484834-20120402-01. [PMID: 22476535]
6. Barranquero-Herbosa M, Abajas-Bustillo R, Ortego-Maté C. Effectiveness of flipped classroom in nursing education. a systematic review of systematic and integrative reviews. Int J Nurs Stud. 2022 Nov:135:104327. doi: 10.1016/j.ijnurstu.2022.104327. [PMID: 35944288]
7. Kim H, Kim Y-H. An action research on flipped learning for fundamental nursing practice courses. Journal of Korean Academy of Fundamentals of Nursing. 2017;24(4):265-76. doi: 10.7739/jkafn.2017.24.4.265.
8. Mirdehghan FA, Keshmiri F, Nasiriani KH. Comparison the Effect of Flipped Classroom and Traditional Education on the Knowledge of Using Selected Medical Equipment in Nursing Students. Medical Education Journal. 2021; 9(1): 71-59. [In Persian]
9. Lee YS, Eun Y. The effect of the flipped learning on self-efficacy, critical thinking disposition, and communication competence of nursing students. The Journal of Korean Academic Society of Nursing Education. 2016; 22(4): 567-76. doi: 10.5977/jkasne.2016.22.4.567.
10. Fakhari E, Seyfi N, Najafi M, Ali Vakili M. Process of the utilizing of flipped classroom for knowledge and satisfaction improvement of dental students in the periodontal and pediatric per clinical courses. Journal of Medicine Spiritual Cultivation. 2017; 26(3): 213-8. [In Persian]

11. Kazemi T, Moezzi A, Azdaki N, Amirabadizadeh N, Khosravi Bizhaem S. Study of physiopathic students viewpoints toward Coronary Artery Disease Education by using the inverted class method. Development Strategies in Medical Education. 2021;8(1):13-22. doi: 10.52547/dsme.8.1.13. [In Persian]
12. Wang A, Xiao R, Zhang C, Yuan L, Lin N, Yan L, et al. Effectiveness of a combined problem-based learning and flipped classroom teaching method in ophthalmic clinical skill training. BMC Med Educ. 2022 Jun 23;22(1):487. doi: 10.1186/s12909-022-03538-w. [PMID: 35733187] [PMCID: PMC9219183]
13. Chan E, Botelho MG, Wong GTC. A flipped classroom, same-level peer-assisted learning approach to clinical skill teaching for medical students. PLoS One. 2021 Oct 22;16(10):e0258926. doi: 10.1371/journal.pone.0258926. [PMID: 34679098] [PMCID: PMC8535182]
14. Berman A, Snyder S, Frandsen G. Kozier and Erb fundamental of nursing: conceps, process and practice. 11th ed. British, UK: British Library Cataloguing-in-Publication Data; 2021.
15. Mousavi M. Clinical nursing methods and assessment of physical health status. 7th ed. Tehran: Shahre Ab: Ayandeh Sazan; 2019. [In Persian]
16. Sung YT, Wu JS. The visual analogue scale for rating, ranking and paired-comparison (VAS-RRP): A new technique for psychological measurement. Behav Res Methods. 2018 Aug;50(4):1694-1715. doi: 10.3758/s13428-018-1041-8. [PMID: 29667082] [PMCID: PMC6096654]
17. Araghian Mojarad F, Alishah M, Bagheri-Nesami M. Comparison of the Effect of Teaching the Nursing Process Using the Two Methods of Flipped Class and Conceptual Map with Flipped Class on Self-Regulation Learning Strategies and Satisfaction of Nursing Students. J Mazandaran Univ Med Sci. 2024; 33 (228): 125-34. [In Persian]
18. Adib-Hajbaghery M. Effect of Three Educational Methods on Anxiety Learning Satisfaction and Educational Progression in Nursing Students. Strides Dev Med Educ. 2008; 5(1): 35-42. [In Persian]
19. Vogelsang K, Droit A, Liere-Netheler K. Designing a flipped classroom course–a process model. Enterprise Modelling & Information Systems Architectures. 2019;14(4):1-23. doi: 10.18417/emisa.14.4.
20. Joseph MA, Roach EJ, Natarajan J, Karkada S, Cayaban ARR. Flipped classroom improves Omani nursing students performance and satisfaction in anatomy and physiology. BMC Nurs. 2021 Jan 2;20(1):1. doi: 10.1186/s12912-020-00515-w. [PMID: 33388055] [PMCID: PMC7778794]
21. Al-Mugheed K, Bayraktar N. Effectiveness of a venous thromboembolism course using flipped classroom with nursing students: A randomized controlled trial. Nurs Forum. 2021 Jul;56(3):623-629. doi: 10.1111/nuf.12573. [PMID: 33782992]
22. Ruzafa-Martínez M, Molina-Rodríguez A, Pérez-Muñoz V, Leal-Costa C, Ramos-Morcillo AJ. Effectiveness of the flipped classroom methodology on the learning of evidence-based practice of nursing students: Quasi-experimental design. Nurse Educ Today. 2023 Sep:128:105878. doi: 10.1016/j.nedt.2023.105878. [PMID: 37352765]
23. Diningrat SWM, Ngussa BM. Effect of Online Flipped Classroom on Students' Self-Directed Learning: A Case of Some Universities in Indonesia. Journal of Educators Online. 2022;19(3):n3.
24. Norouzi A, Zazoly AZ, Sohrabi Z, Ramezani G, Pourbairamian G, Keshavarzi MH, et al. Comparison of the Effect of Teaching Methods of Flipped Class and TBL in Enhancing Psychological Empowerment. J Adv Med Educ Prof. 2023 Jul;11(3):172-178. doi: 10.30476/JAMP.2023.95631.1652. [PMID: 37469379] [PMCID: PMC10352671]
25. Dong Y, Yin H, Du S, Wang A. The effects of flipped classroom characterized by situational and collaborative learning in a community nursing course: A quasi-experimental design. Nurse Educ Today. 2021 Oct:105:105037. doi: 10.1016/j.nedt.2021.105037. [PMID: 34247009]
26. Tsay CHH, Kofinas AK, Trivedi SK, Yang Y. Overcoming the novelty effect in online gamified learning systems: An empirical evaluation of student engagement and performance. Journal of Computer Assisted Learning. 2020;36(2):128-46. doi: 10.1111/jcal.12385.
27. Wang Q, Zhao H, Fan J, Li J. Effects of flipped classroom on nursing psychomotor skill instruction for active and passive learners: A mixed methods study. J Prof Nurs. 2022 Mar-Apr:39:146-155. doi: 10.1016/j.profnurs.2022.01.013. [PMID: 35272822]
28. Wang Y-C, Cheng H-L, Deng Y-M, Li B-Q, Zhou X-Z. Effectiveness of the combination of workshops and flipped classroom model to improve tube fixation training for nursing students. World J Clin Cases. 2022 Mar 16;10(8):2447-2456. doi: 10.12998/wjcc.v10.i8.2447. [PMID: 35434064] [PMCID: PMC8968585]
29. Talan T, Gulsecen S. The effect of a flipped classroom on students' achievements, academic engagement and satisfaction levels. Turkish Online Journal of Distance Education. 2019;20(4):31-60. doi: 10.17718/tojde.640503.
30. Yeh Y-C. Student satisfaction with audio-visual flipped classroom learning: a mixed-methods study. Int J Environ Res Public Health. 2022 Jan 18;19(3):1053. doi: 10.3390/ijerph19031053. [PMID: 35162077] [PMCID: PMC8834006]
31. Khodaei S, Hasanvand S, Gholami M, Mokhayeri Y, Amini M. The effect of the online flipped classroom on self-directed learning readiness and metacognitive awareness in nursing students during the COVID-19 pandemic. BMC Nurs. 2022 Jan 19;21(1):22. doi: 10.1186/s12912-022-00804-6. [PMID: 35042484] [PMCID: PMC8766221]
32. Bognar B, Sablić M, Škugor A. Flipped Learning and Online Discussion in Higher Education Teaching. In: Daniela, L. (eds) Didactics of Smart Pedagogy. Cham: Springer; 2019. doi: 10.1007/978-3-030-01551-0_19.
33. Youhasan P, Chen Y, Lyndon MP, Henning MA. University teachers' perceptions of readiness for flipped classroom pedagogy in undergraduate nursing education: A qualitative study. J Prof Nurs. 2022 Jul-Aug:41:26-32. doi: 10.1016/j.profnurs.2022.04.001. [PMID: 35803656]

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Review Article

What Types of Aims Are Out There in a Higher Education System: A Narrative Review

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Abstract

Background: Higher education plays a crucial role in economic, social, and cultural development, but it is facing a range of challenges, including globalization, highly competitive world, as well as the rapid development and application of technology. These challenges also arise and affect the health sector. It is essential to address the aims of education, as not only it reflects the cultural, social, and political philosophy of a country but also express the most important values that govern that society.

Objectives: The main objective of this study is to identify and categorize the types of aims mentioned for the higher educational systems and explore their significance as well as the existing approaches used to determine aims within the higher education system.

Methods: A narrative review was used to examine the available evidence on the aims of education. The study's objectives were divided into several sections to address following questions: a) What are the various types of educational aims? b) In what ways are aims demonstrated or realized within the realm of higher education? c) What is the connection between aims and the educational objectives in contemporary education systems? In this regard, we examined research papers and the governmental documents of educational systems.

Results: The aims of higher education could be categorized into four key areas: intellectual achievement, individual growth and development, social growth and socialization, and economic competition.

Conclusion: To thrive in the third millennium, it is imperative for higher education systems to establish clear and transparent aims that can effectively address the challenges they currently face. Thus, it is crucial to comprehend the relationship between these concepts and factors, and define a desired aim based on local values in every education system.

Keywords: Education; Aims; Goals; Objective; Higher Education

Background

The purpose of education is empowering individuals to analyze and solve problems, through the acquisition and effective management of knowledge.

At a higher level the term "aim" can be broadly understood as "desired meaning," "end," or "goal." However, this definition emphasizes a crucial distinction: the aim refers to the intended outcome, not the underlying purpose or rationale (1, 2). Education provides the pathway to achieving these intended outcomes. It involves mastering skills, effectively managing knowledge, analyzing problems, and deepening one's understanding of ideas, ultimately leading to enhanced experiences and profound freedom (3).

In the field of education, "aim" refers to the articulation of prescriptive statements that outline the intended outcomes for learners upon the completion of the educational process. The effectiveness and desirability of these statements are dependent on the aims that are defined for them (4).

The ultimate aim is to articulate goals for individuals and society as a whole, while general goals are more immediate and qualitative in nature. Objectives, on the other hand, are expressed in a clear, precise, and often

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quantitative manner (aim-goal-objective). Aims typically determine general and objective goals and serve as the foundation for establishing educational strategies and related programs (5, 6).

Throughout human civilization, philosophers, thinkers, and scholars have held diverse viewpoints on the ideals and aims of education. However, they unanimously agree that the ultimate outcome of education should involve the transmission and cultivation of virtue (7-9).

On the one hand, education promotes the individual, nurturing their inner world and facilitating the growth as well as realization of moral values, spiritual awareness, self-discovery, inner freedom, intellectual acuity, aesthetics, and the enhancement of personal relationships. It also enhances cognitive abilities, empathy, capabilities, and practical skills. On the other hand, education enhances individuals' interaction with the world they inhabit, encompassing both the natural environment and human society (10-14).

The determination and selection of aims within the value framework that governs the education system hold significant meaning and are influenced by the specific perspectives on human beings. As such, the description of human beings and their characteristics within a system serve as guiding principles for researchers in defining educational aims, goals, foundations, principles, and methodologies within that particular system (9, 13-15).

The aims of education can be viewed from two perspectives. First, they can be seen as transcendental goals that hold value regardless of specific time periods, cultures, or social norms throughout history. Secondly, they can be shaped by the societal assumptions of a particular group, place, and time, reflecting specific social or cultural values. However, it is important to note that the determination and articulation of educational aims should align with the prevailing human values within a society (16, 17).

When we talk about the aims of the education system, we are referring to those that empower, regulate, and provide guidance to the education system (18-20).

In the modern world, where there are immense pressures for policy changes in all dimensions of education systems, it becomes increasingly crucial to develop a goal-setting model to address an unknown future. It is widely acknowledged by philosophers, experts, and policymakers that the direction, progress, and development of education systems rely on the determination and formulation of their aims. However, there is still limited consensus on a set of new aims that align with the skills and competencies required in the 21st century due to the varying values that govern societies (9, 21-24).

It is also essential to interpret and promote the aims of education in alignment with the values that prevail in society**.** Challenges such as globalization of markets, technological advancements, and intensified international competition have led to higher expectations and demands placed on the educational system (25, 26).

To address this challenge, higher education systems need to move away from educational curricula that are solely focused on objective goals, standardized approaches, and uniform evaluations to the development of aims (27). The development of aims in higher education typically aligns with the goal-setting model established by the Ministry of Education in each country. This review study was conducted to define the concept of aims in the higher education system and explore their significance as well as the existing approaches used to determine aims within the higher education system (28).

Objectives

This review study was conducted to define and categorize the concept of aims in the higher education system and explore their significance as well as the existing approaches used to determine aims within the higher education system.

The research questions include: a) What are the various types of educational aims? b) In what ways are aims demonstrated or realized within the realm of higher education? c) What is the connection between aims and the educational objectives in contemporary education systems?

Methods

This narrative review study investigated the existing evidence on the aims of education within the higher education system.

Study Selection: To access relevant resources within Iran, the researchers conducted searches in the SID and Magiran databases using keywords such as aim, general goal, objective goal, mission, education system, and higher education system. Additionally, individual or mixed searches were conducted in various international databases, including Google Scholar, PubMed, Scopus, ProQuest, Ovid, and ScienceDirect using keywords such as aim, goal, objective, mission, and higher education.

The inclusion criteria were both quantitative and qualitative studies, books, and documents that were relevant to the research question. The timeframe for examining governance documents was set from 2000 to 2023, while other sources were not limited to a specific time period.

Study Sample: The study sample consisted of 100 documents, including government documents, philosophical books, and related articles, relevant to the research question. Both quantitative and qualitative studies, books, and documents were considered.

Data Collection: Relevant resources were identified through searches in Iranian databases (SID, Magiran) and international databases (Google Scholar, PubMed, Scopus, ProQuest, Ovid, ScienceDirect). Keywords used included aim, general goal, objective goal, mission, education system, and higher education. The search timeframe for governance documents was 2000-2023; no date restriction applied to other sources

Data Analysis: The 100 selected documents were examined to identify key themes and patterns related to the aims of higher education. A narrative synthesis approach was employed to synthesize and interpret findings, providing a comprehensive overview of the research topic.

Note that in many countries, higher education operates as a subset of the Ministry of Education and is not inherently independent. In cases where higher education institutions are independent, they typically follow the pattern of determining and formulating educational aims, which is usually established at the highest level of policy-making within the respective country. However, in Iran, higher education is regulated by two governing bodies: Ministry of Health, Medical Education and Treatment, plus the Ministry of Science. As a result, the discussion of aims in higher education in Iran includes the health-related higher education system as well.

Results

The findings of the reviewed studies were categorized according to the research objectives and were presented in several sections to address the following questions: a) What are the main characteristics of the various types of educational aims? b) How do society's aims influence the development of its values? c) In what ways are aims demonstrated or realized within the realm of higher education? d) How is the connection between aims and the educational curriculum (or the operation of the education system) established in contemporary education systems? (Table 1).

Table 1. Key Research Questions and Findings

Research Question	Key Findings (Summary Statement with References)
A) What are the main characteristics of the various types of educational aims?	-Historical Shift: (29) -Generality & Ambiguity: (8) -Democratic Societies aims: (12, 30) -Categorization of Aims: (18, 31, 32) -Specific Aims: (33-41) -Influence on Prioritization: (8, 42)
B) How do society's aims influence the development of its values?	-Education's Role in Value Development: (33, 43) -Interplay of Aims and Values: (18, 44) -Values as Transcendent Goods) (18, 44) -Approaches to Integrating Values (7) -Cultural Aims and Education: (21) -Prioritizing Cultural Values: (19, 45)
C) In what ways are aims demonstrated or realized within the realm of higher education?	-Global Role & University Functions: (9, 46) -Diverging Aims & Formulation:(47) -Historical Views & "Idea of University(47, 48) -Core Concepts & Common Ground:(21, 49-53)
D) How is the connection between aims and the educational curriculum (or the operation of the education system) established in contemporary education systems?	-Influence of Context & Need for Reevaluation: (54) -Prioritizing Aims & Modern Considerations: (44, 62) -Curriculum Alignment & Challenges: (20)

A) What are the various types of educational aims?

In the past, the aim of education was to transfer wisdom and cultivate virtue, whereas modern educational institutions primarily focus on subject-based learning. The decline of the aim of acquiring wisdom and its replacement with textbook knowledge is one of the factors contributing to the ineffectiveness of education systems (29).

In most countries worldwide, aims are often articulated generally in the education systems. John White highlights that the aims of the education system in the U.K span only about twelve lines. This brevity of articulating aims, considering the significant responsibility bestowed upon educational institutions as representatives of the system, is insignificant, illogical, and ambiguous. Moreover, these documented aims do not fully apply to higher education institutions (8).

When exploring the education systems of democratic societies, two common aims frequently arise: equipping learners for active participation in democratic life, and preparing educated citizens (30-55).

The aims of education can be categorized as either intrinsic, focusing on lifelong learning, knowledge and skill development, and understanding for both individuals and society, or instrumental, aiming to prepare young individuals for work and the national economy. These aims may emphasize the development of individual characteristics or capacities, promotion of citizenship and social cohesion, or the preservation of cultural heritage (19, 32).

The aims of education systems can be understood at either the individual or community level, manifested either openly or covertly, and rooted in specific values or interests. Upon reviewing governance texts and documents, several aims have been identified, including lifelong learning, logical and critical thinking, autonomy, moral integrity, creativity, innovation, independence, self-flourish for individuals and society, democracy, adaptability to changes, equal opportunities, nationalism, international unity, social justice, belief in God, national unity, freedom, transparency, economic growth, and sustainable development (21, 33-39, 53).

Liberals highlight the significance of education as an individual good with intrinsic value, while socialists perceive education as a means of social and practical good or as conflicting with intrinsic value. Applied aims of education are further categorized as professional or social. These aims are not necessarily contradictory as long as their position is defined. For instance, an individual can be educated to become autonomous or independent, which is an intrinsic good, while also being educated as a responsible citizen and productive member of society. Ultimately, the prioritization of aims is influenced by prevailing attitudes, values, and policies. Policymakers, philosophers, and researchers often align the aims of education to support their own perspectives (8, 42).

B) How do society's aims influence the development of its values?

Education should reflect enduring values that contribute to the formulation and pursuit of aims. These values encompass individual, social, and family values. Additionally, the cultivation of virtues such as truth, justice, honesty, trust, and a sense of duty should be regarded as fundamental educational values. The belief that education serves as a pathway to foster spiritual, moral, social, cultural, physical, and mental growth, thereby promoting individual well-being. It also facilitates the establishment of equal opportunities, a robust and fair democracy, a prosperous economy, and sustainable development (33, 43).

The relationship between educational aims and societal values is complex. Aims are influenced by prevailing norms and values, while education also serves to reflect and reinforce these values, contributing to the formation of the desired societal model. Thus, identifying shared values that underpin education is crucial, though the process itself can be challenging. Scholarly debate exists regarding the nature of this relationship, with some arguing values are defined by evolving societal goals, while others posit intrinsic, independent values that should guide educational aims (18).

Sometimes, the aims of education are viewed as transcendent goods that are linked to values that are not dependent on specific cultural or social norms. In this perspective, the pursuit of knowledge, intellectual growth, or moral character is considered as a shared interest. However, if the values promoted in education are in conflict with an individual's society or cultural group, it may lead to a sense of detachment or alienation from their society or culture (7, 18, 44).

Cultural aims represent the values that all nations strive to transmit and perpetuate within their societies. In simpler societies, cultural values may be informally transferred through daily interactions, while in contemporary advanced and pluralistic societies, specific mechanisms are required for this purpose. Education systems and institutions serve as the primary platforms for presenting and transmitting cultural values. Through the formulation and articulation of aims, these systems primarily foster knowledge, skills, and attitudes that align with cultural values. This process is commonly known as an educational curriculum and is followed within education systems (20).

The extensive dissemination of cultural values contradicts the limited capacity of educational institutions, making it unrealistic to expect these institutions to transmit every aspect of societal culture. Prioritizing values becomes crucial in this context. Upon examining governance documents, it becomes evident that education systems employ criteria to select cultural values for inclusion in their structures. These criteria not only avoid unethical instances such as racial discrimination and racism but also ensure alignment

with governmental or political values. Some researchers argue that this approach can overlook moral significance or social responsibility (19, 43).

C) In what ways are aims demonstrated or realized within the realm of higher education?

The philosophy of higher education embraces a global perspective that acknowledges the potential for investigating and researching any subject, making it possible to observe the entirety of the world within the university setting. This perspective forms an integral part of the essence of the university. Universities and other institutions of higher education hold significance not only in terms of training skilled professionals but also in expanding the frontiers of knowledge, fostering personal growth, promoting community development, and facilitating global competition (9, 45).

Barnett explored the aims of higher education, contrasting policymaker and philosopher perspectives. Policymakers prioritize practical, market-oriented aims focused on human resource development, global competitiveness, and market demands. Philosophers, conversely, take a more holistic view, considering the full range of human experience—thoughts, emotions, and aspirations—in formulating educational aims (55).

This difference in perspective is reflected in how aims are conceptualized. In higher education, a common approach is to formulate aims for specific courses or related subjects, outlining a particular path. In contrast, a broader conceptual approach encompasses the entire field of education (55).

The endeavor to define the aims of higher education is not a novel concept. Whitehead considered the role of "universities and their performance," and advocated that the proper functioning of a university should be grounded in the aim of creative and imaginative acquisition of knowledge (48).

Gasset asserted that the mission of the university was to provide students with a comprehensive exposure to modern culture through the provision of a dynamic and living system of ideas across courses (49). In his analysis of articles published over the past 150 years, Barnett drew a distinction between the aims and the idea of higher education. He observed that authors of articles pertaining to the "idea of higher education" often amalgamated their perspectives on the aims of higher education with the concept itself (55).

The idea of the university revolves around an educational process where knowledge itself is considered the ultimate aim. Newman put forth a viewpoint that defines university education not in terms of acquiring specific types of knowledge or professional competence, but rather as fostering the overall development and higher order. The realization and development of these capacities will enable learners to derive benefits beyond the university setting and effectively navigate real-world circumstances (46, 50, 55).

Similarly, John Stuart Mill argues that the university is not solely a place for professional education. Students should first learn to be well-rounded individuals before becoming lawyers, doctors, or practitioners in any field. The university should imbue professionals with the guidance to apply their specialized knowledge within the framework of values and the broader public culture (51).

While the various concepts of aims in higher education may differ in their articulation, they share a common characteristic: their value primarily stems from the future benefits they offer to society and learners. In essence, learners should be equipped with the capacity and capability to express themselves beyond the confines of a purely scientific curriculum. This implies that the aim of education in higher education institutions is the holistic and comprehensive development of learners, enabling them to navigate the complexities, uncertainties, and realities of life and society.

D) How is the connection between aims and the educational curriculum (or the operation of the education system) established in contemporary education systems?

Throughout different historical periods, the aims of education across various fields have been shaped by philosophical perspectives, specific disciplines, and governing policies. The shifting social structures, growing influence of globalization, reality of multiculturalism, pluralistic societies, and intense competition prevalent in all social and economic sectors necessitate a reevaluation of the university's role within the education system. Thus, the aim of education within the university should be defined as the establishment and development of a robust educational institution that enables learners to successfully integrate as individuals, professionals, and socially engaged members (53).

John White asserts that the education system should prioritize aims rather than focusing solely on the structure. Accordingly, the entire effort of the system

should be directed towards identifying and realizing national aims (35).

In the modern world, White identifies two scenarios for examining and formulating the aims of education:

1- The aims should be examined and formulated in light of factors such as increased life expectancy, the expansion of the Internet, shifts in work patterns, climate change, growing inequality, and the rise of populism. These factors profoundly impact how we think about education and shape our way of life in general.

2- The examination and formulation of educational aims should focus on equipping learners to lead fulfilling personal lives. Learners should be motivated to pursue meaningful work for its own sake and maintain a curiosity to explore new realms. Central to these aims is the concept of a fulfilling personal life, which encompasses the well-being of oneself and others (38).

While the inclusion of subjects in educational curriculum is ultimately justified by the aims of the education system itself, it does not necessarily guarantee that these curricula effectively align with those aims. For instance, learning and behavioral objectives may be tailored to post-graduation performance and vary across different curricula. While some aims of education hold relevance in a professional context, the most significant aims remain consistent across various curricula.

Although there exists a logical relationship between the aims of education and the educational curriculum, it is not always easy to formulate comprehensive or objective goals for the educational curriculum based solely on these overarching aims, since the aims may be implicitly expressed, or there may exist multiple ways to achieve them. Despite these challenges, it is imperative not to overlook the development of such valuable aims (19).

By examining the documentation of education systems, studies and researches, the key areas in which the aims of higher education have been reviewed and formulated are as follows (Table 2).

Table 2. Key areas of higher education Aims from Documentation and Research

Areas of Aims	Definition of Aims
Intellectual achievement	Preparing individuals with scientific knowledge and skills for societal roles (9, 30, 47)
Social growth and socialization	Preparing responsible citizens who embrace societal norms and values (9, 53-58)
Economic competition	Equipping learners with skills and knowledge for the global economy, making them effective workforce members (18, 59, 60)
Personal development and growth	Fostering self-flourishing, enhancing personal communication, clarifying personal values, developing effective communication skills (2, 8, 42, 61, 62)

Intellectual achievement: Aims in this domain are established based on scientific knowledge and skills to prepare individuals for their roles in society. There is a general consensus on these aims, as parents aspire for their children to attain high levels of competence which will enable them to secure good positions in society. Policymakers tend to excel in the global competition and ultimately realize an ideal society comprised of content and fulfilled individuals (9, 30, 55).

Social growth and socialization: This area focuses on preparing learners to become responsible citizens who embrace societal norms and values. This aspect holds particular significance for policymakers in any given society, as they emphasize the values upheld in their desired societal framework. These values include patriotism, obedience, honesty, cooperation, competitiveness, and moral responsibility. Furthermore, in line with the aims of education, learners should be encouraged to engage in social services or service learning, enabling them to reflect upon and respond to the needs and challenges of their society (9, 55-58).

Economic competition (social efficiency): The aims in this realm are based on equipping learners with the necessary skills and knowledge to thrive in the global economy, thereby transforming them into effective and efficient members of the workforce. Cultivating attitudes such as punctuality, cooperation, and adherence to rules are important considerations within this framework (18, 60, 63).

Personal development and growth: The aims in this domain are designed to foster students' self-flourish, enhance personal communication, clarify personal values, and develop effective communication skills (2, 8, 42, 62, 64).

Strengths and limitations: This study had strengths and limitations. One of its strengths is that no study has comprehensively examined all types of higher education system aims across programs and countries. However, since this study is a narrative review, it lacks the

coherence and structure of other types of review studies, such as systematic reviews.

Conclusion

Research indicates that education systems often prioritize political and governance interests, which can result in conflicts or incompatibilities among various aims and goals.

However, to achieve success in the third millennium, it is crucial to address the fundamental structure, nature, communication methods, and the distinctive role of aims, including general and objective goals.

The reviewed evidence regarding the education system, particularly higher education, and its relationship with the aims of education demonstrated that these aims were derived from the cultural, social, and political values of the society, thereby forming a set of values. It is essential for higher education institutions to clearly and transparently define their aims to overcome existing crises. Thus, it can be stated that as one of the applications of this study, the country's educational policymakers, by understanding the importance of aims in formulating educational policies and considering the impact of social and cultural values on these ends, can formulate policies that, in addition to being oriented in line with the desired values, also enjoy greater social acceptance.

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References

1. Cambridge Dictionary. Aims. Cambridge, UK: Cambridge University Press.
2. Scoular C, Teo I. Developing strategic plans for an aligned approach to 21st century skills integration. Australian Council for Educational Research. 2021. [cited 2021 Mar 8]. Available from: URL:https://research.acer.edu.au/cgi/viewcontent.cgi?article=1058&context=ar_misc
3. Whitehead AN. The aims of education. Daedalus. 1959;88(1): 192-205.
4. Supreme Council of the Cultural Revolution. The Fundamental Reform Document of Education. Tehran, Iran: Secretariat of the Supreme Council of the Cultural Revolution; 2012. [In Persian]
5. Koy L. Comparative Education. Tehran, Iran: SAMT Pub; 2009. [In Persian]
6. Noddings N. Aims, goals, and objectives. Encounters in Theory and History of Education. 2007;8: 7-15. doi:10.24908/eoe-ese-rse.v8i0.571.
7. Singh RR. Education for the twenty-first century: Asia-Pacific perspectives. Bangkok, Thailand: UNESCO Principal Regional Office for Asia and the Pacific; 1991.
8. White JP. The aims of education restated. London, UK: Routledge; 2010.
9. Brighouse H, McPherson M. The aims of higher education: Problems of morality and justice. The Chicago, US: University of Chicago Press; 2019.
10. Robertson E. The Epistemic Aims of Education. In: Siegel H, editor. The Oxford Handbook of Philosophy of Education. Oxford: Oxford University Press; 2009:11-34. doi:10.1093/oxfordhb/9780195312881.003.0002.
11. Siegel He. The Oxford Handbook of Philosophy of Education. In: Siegel H, editor. Oxford: Oxford University Press; 2009. doi:10.1093/oxfordhb/9780195312881.001.0001.
12. Hand M, White J. Rethinking the school curriculum: Values, aims and purposes. London, UK: Routledge; 2003.
13. Nakib O. The Nature of the Aims of Education: Quranic Perspectives. Al-Bayan: Journal of Qur'an and Hadith Studies. 2015;13(1):25-46. doi: .
14. Motahari M. The Perfect Man. Tehran, Iran: Nashr Sadra Pub; 2009. [In Persian]
15. Brubacher JS. Modern philosophies of education. 3rd ed. New York: McGraw-Hill; 1969.
16. Burbules NC. Ways of thinking about educational quality. Educational Researcher. 2004;33(6):4-10. doi:10.3102/0013189X033006004.
17. Poudeh Z, Karami Robati F, Ahmadi A, Dehghani M, Shahsavari M, Amirheidari B, et al. The Current Outlook in the Internationalization of Medical Education in Pakistan. Strides in Development of Medical Education, 2024; 21(1): 8-16. doi: 10.22062/sdme.2024.199084.1292.
18. Winch C, Gingell J. Philosophy and educational policy: A critical introduction. 1st Ed. London, UK: Routledge Falmer; 2004. doi:10.4324/9780203465431.
19. Gingell J, Winch C. Philosophy of education: The key concepts. 2nd Ed. London, UK: Routledge; 2008. doi:10.4324/9780203927588.
20. Ministry of Education Malaysia. Blueprint 2015–2025 (Higher Education). Putrajaya Malaysia: Kementerian Pendidikan Malaysia; 2015.
21. Gökçe AT, Celep C. A Comparison of Educational Systems of Turkey, Malta, Ireland, Spain, Sweden, Portugal, Finland, Greece, Belgium, the Netherlands and Denmark. Online Submission. 2011; 1(4): 547-57.
22. Wang Y, Lavonen J, Tirri K. Aims for learning 21st century competencies in national primary science curricula in China and Finland. Eurasia Journal of Mathematics Science and Technology Education. 2018; 14(6): 2081-95. doi:10.29333/ejmste/86363.
23. Cook JW. Sustainability, human well-being, and the future of education. 1st ed. Cham, Switzerland: Springer Nature; 2019. doi:10.1007/978-3-319-78580-6.
24. Bhardwaj A. Importance of education in human life: A holistic approach. International Journal of Science and Consciousness. 2016 Jun;2(2):23-8.
25. Shrivastava S, Pradipta K. Empowering the Healers: Strengthening Self-Efficacy and Learning Environment in Boosting Academic Resilience. Strides Dev Med Educ. 2024; 21(1): 48-52. doi: 10.22062/sdme.2024.199010.1282.

26. Torrance H. Postmodernism and educational assessment. In: Assessment: Social Practice and Social Product. Filer A. Edition no. London: Routledge; 2000: 173-88.
27. Altbach PG, Reisberg L, Rumbley LE. Trends in global higher education: Tracking an academic revolution. Paris, France: UNESCO Pub; 2019: 22.
28. Peters RS, Woods J, Dray WH. Aims of Education-Conceptual Inquiry. In: Philosophy of Education. Peters RS. (Ed). London: Oxford University Press; 1987.
29. White J. National myths, democracy and education. In: Bridges D. Education, Autonomy and Democratic Citizenship. London: Routledge; 2002: 31-8.
30. Brighouse H, Mullane K. Aims and Purposes of a State Schooling System: The Case of California. Technical Report. Getting Down to Facts II. Policy Analysis for California Education, PACE. [cited 2018 Sep 8]. Available from: URL: https://gettingdowntofacts.com/sites/default/files/2018-09/GDTFII_Report_Brighouse.pdf.
31. Le Métais J. Values and aims in curriculum and assessment frameworks. London: Qualifications and Curriculum Authority London, 1997.
32. Broadfoot P. Comparative education for the 21st century: retrospect and prospect. Comparative Education. 2000;36(3):357-71. doi:10.1080/03050060050129036.
33. McCulloch, G. Finnish lessons 2.0: what can the world learn from educational change in Finland? By Pasi Sahlberg, The Finnish education mystery: historical and sociological essays on schooling in Finland. By Hannu Simola. British Journal of Educational Studies. 2017; 65(2): 265-8. doi: 10.1080/00071005.2017.1312818.
34. Noddings N. Education and democracy in the 21st century. New York: Teachers College Press; 2013.
35. White J. A New Public Education for England. Forum. 2019;61(2): 175-82. doi:10.15730/forum.2019.61.2.175.
36. Zhu Y. New national initiatives of modernizing education in China. ECNU Review of Education. 2019; 2(3): 353-62. doi:10.1177/2096531119868069.
37. United Nations Development Programme (UNDP). National Human Development Report 2019. China, Beijing: United Nations Development Programme (UNDP); 2019.
38. White J. Education in an uncertain future: Two scenarios. London Review of Education. 2020; 18(2): 299-312. doi:10.14324/LRE.18.2.11.
39. Ministry of Education C, Sports, Science and Technology. The Future of Higher Education in Japan. [cited 2016 Jan 28]. Available from: URL:Available from: https://www.mext.go.jp/en/policy/education/highered/title02/detail02/1373887.htm
40. Visakorpi J, Stankovic F, Pedrosa J, Rozsnyai C. Higher education in Turkey: Trends, challenges, opportunities. İstanbul: European University Association (EUA); 2008.
41. Gatley J. Intrinsic value and educational value. Journal of Philosophy of Education. 2021;55(4-5):675-87. doi:10.1111/1467-9752.12555.
42. Gökçe AT, Celep C. A Comparison of Educational Systems of Turkey, Malta, Ireland, Spain, Sweden, Portugal, Finland, Greece, Belgium, the Netherlands and Denmark. Wilmington, Delaware, US: David Pub; 2011.
43. Kiryakova AV, Olkhovaya TA, Melekesov GA, Presnov AA. The axiological approach to the analysis of the problems of modern university education. Mediterranean Journal of Social Sciences. 2015;6(2 S3):22. doi:10.5901/mjss.2015.v6n2s3p22.
44. Marples R. The aims of education. London: Routledge; 2012. doi:10.4324/9780203003985.
45. Madhoushi M, Niyaz E. Examining the Position of Iranian Higher Education in the World. Iranian Higher Education. 2010;2:113-49. [In Persian]
46. Atar C, Rahman SA. Higher Education in Turkey: Responding to Sustainable Development Agenda. Intellectual discourse. 2019;27(2):335-52.
47. Barnett R. The philosophy of higher education: A critical introduction. 1 st Ed. London: Routledge; 2021. doi: 10.4324/9781003102939.
48. Whitehead AN. Universities and their Function. Bulletin of the American Association of University Professors (1915-1955). 1928;14(6):448-50. doi:10.2307/40218022.
49. Gasset JO y. Mission of the University. 1st Ed. London: Routledge; 2014. doi:10.4324/9781315008059.
50. Gordon B. Newman, and the changing scene in University education. Int Rev Educ. 1963; 9:1-11. doi:10.1007/BF01416470.
51. Donner W. John Stuart Mill on education and democracy. New York: Cambridge University Press; 2007. doi:10.1017/CBO9780511618734.011.
52. Council of Higher Education. Higher education system in Turkey. Ankara; 2019. [cited 2019 Jan 8]. Available from: URL: https: https://www.yok.gov.tr/Documents/Yayinlar/Yayinlarimiz/2019/Higher_Education_in_Turkey_2019_en.pdf.
53. Aggelakos C. The cross-thematic approach and the 'new'curricula of Greek compulsory education: Review of an incompatible relationship. Policy Futures in Education. 2007;5(4):460-7. doi:10.2304/pfie.2007.5.4.460.
54. White J. Rethinking the school curriculum: Values, aims and purposes. London: Routledge; 2004: 195.
55. Barnett R. Does higher education have aims? Journal of Philosophy of Education. 1988;22(2):239-50. doi:10.1111/j.1467-9752.1988.tb00197.x.
56. Geyer R, Rihani S. Complexity and public policy: A new approach to 21st century politics, policy and society. London: Routledge; 2010. doi:10.4324/9780203856925.
57. Hopkins N. Citizenship and democracy in further and adult education. Dordrecht: Springer; 2014. doi:10.1007/978-94-007-7229-8.
58. Grace G. Education is a Public Good: On the Need to Resist the Domination of Economic Science. In: Bridges D, Mclaughlin TH. Education and the Market Place. London: Taylor & Francis; 2005: 126-36.
59. Ministry of Education C, Sports, Science and Technology (MEXT). The Interim Report by the University Council of Japan. [cited 2011 Jan 19]. Available from: URL: https://www.mext.go.jp/en/policy/education/highered/title02/detail02/__icsFiles/afieldfile/2011/04/13/1304955_001.pdf.
60. Hopkins N. Democratic Socialism and Education: New Perspectives on Policy and Practice. Dordrecht: Springer; 2019.
61. White J. Philosophy and the aims of higher education. Studies in Higher Education. 1997; 22(1): 7-17. doi:10.1080/03075079712331381101.
62. Chapple J. Mission accomplished? School mission statements in NZ and Japan: What they reveal and conceal. Asia Pacific Education Review. 2015;16(1):137-47. doi:10.1007/s12564-015-9360-2.
63. Organisation for Economic Co-operation and Development(OECD). Education Policy Outlook 2019: Working Together to Help Students Achieve their Potential. France, Paris: OECD Pub: 2019.
64. White J. Aims of Education in a Democracy. In: Wyse D, Hayward L, Pandya J, editors. The SAGE Handbook of Curriculum, Pedagogy and Assessment: Two Volume Set. London: SAGE Pub; 2016: 63-77. doi:10.4135/9781473921405.

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Review Article

Identifying the Applications of Artificial Intelligence in the Assessment of Medical Students

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Abstract

Background: AI has rapidly transformed education, research, and community services in medical universities, surpassing earlier expectations about its integration. A key area of this transformation is student assessment, which plays a vital role in shaping learning outcomes, faculty workload, and public trust in medical education.

Objectives: This study aims to explore the applications of AI in the assessment of medical students through a content analysis of relevant scholarly literature.

Methods: This qualitative study employed a meta-synthesis method following Walsh and Downe's seven-step framework. Using targeted keywords, a comprehensive search was conducted across major databases, including ScienceDirect, Springer, ERIC, Emerald, Sage Journals, Wiley Online Library, PubMed, and Google Scholar, covering publications from 2015 to 2024. A total of 200 articles were initially retrieved; after applying quality appraisal criteria, this number was narrowed down to 24 studies. To ensure the credibility of the findings, Whittemore et al.'s ten indicators for methodological rigor were applied.

Results: Six key themes emerged regarding AI applications in medical student assessment: (a) feedback, (b) online exam, (c) instrument design, (d) assessment process, (e) student learning management, and (f) faculty workload management, along with 19 sub-themes. These findings reflect the diverse and evolving impact of AI in assessment practices.

Conclusion: This study underscores the multifaceted and transformative impact of AI in medical student assessment across six key domains. These applications serve as a strategic roadmap for seamlessly integrating AI into the assessment of medical students while effectively adapting to evolving educational paradigms.

Keywords: Artificial Intelligence; Medical Education; Student Assessment; Meta-Synthesis; Educational Technology

Background

The rapid and continuous advancement of Artificial Intelligence (AI) within higher education has made predicting its trajectory with certainty increasingly difficult. However, what remains clear is that AI's integration into education is inevitable. Policymakers and stakeholders must remain vigilant in monitoring emerging challenges and opportunities, adapting their strategies accordingly. Efforts to prohibit or delay its adoption are largely ineffective, as the momentum of technological progress continues to accelerate at an unprecedented pace (1).

To date, AI has significantly influenced both education (1) and research (2). One educational domain that has undergone substantial transformation is online student assessment, which has gained even more significance following the onset of the COVID-19 pandemic (3). Assessment, along with the feedback it generates, plays a central role in shaping and advancing student learning. Far beyond serving as a mere tool for measuring achievement, assessment functions as a core component of the learning cycle—guiding students, informing instruction, and fostering reflective thinking. When thoughtfully designed and paired with timely,

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constructive feedback, assessment becomes a powerful mechanism for deepening understanding, enhancing motivation, and promoting meaningful academic growth. Accordingly, ensuring the effectiveness of assessment practices remains a critical concern in contemporary educational systems (4).

AI holds the potential to revolutionize student assessment approaches (5). Yet, alongside these opportunities, significant challenges remain—particularly within the field of medical education. Ethical concerns (6), unrealistic or fabricated outcomes (7), and academic dishonesty (8) pose substantial barriers to effective implementation. Despite these challenges, the focus of this study is on exploring the potential applications and benefits of AI in assessing medical students.

In today's rapidly evolving educational landscape, stakeholders no longer have the luxury of deciding whether to engage with AI. Its integration is not a matter of choice, but of necessity. Particularly in medical education, the role of assessment is critical—not only in evaluating academic achievement but also in safeguarding the competence and credibility of future healthcare professionals.

Poorly designed or executed assessment practices can have severe and irreversible consequences. Incompetent graduates may jeopardize patient safety and diminish the quality of healthcare services. Moreover, flawed assessments can lead to educational inequities by allowing unqualified individuals to obtain medical credentials, thereby eroding public trust in the medical profession. Ineffective evaluation practices may also fail to identify students' weaknesses, limiting opportunities for improvement and demotivating learners. As such, a precise, evidence-based, and technologically informed assessment system is essential to maintain the integrity of medical education.

Recent scholarship offers valuable insights into the integration of AI in educational assessment. For instance, Perkins et al. (9), in *A Framework for Ethical Integration of Generative AI in Educational Assessment*, introduced the AI Assessment Scale (AIAS), a practical tool for determining the appropriate use of generative AI (GenAI) based on learning objectives. This tool promotes transparency and fairness in educational policies while emphasizing a balanced approach to adopting AI, shifting away from a focus solely on negative aspects such as facilitating cheating.

Similarly, Mahamuni et al. (10), in *Enhancing Educational Assessment with Artificial Intelligence: Challenges and Opportunities*, examined AI's role in improving educational assessments, highlighting how AI technologies can enhance accuracy, fairness, and efficiency. While traditional assessment methods often face limitations in scalability, adaptability, and the provision of personalized feedback, AI-driven approaches, particularly those using machine learning and natural language processing, offer promising solutions to these challenges. The study also proposes an innovative framework that incorporates algorithms and mathematical models to improve decision-making processes within educational systems. At the same time, it underscores the importance of a balanced integration of AI, particularly concerning ethical issues, data privacy, and digital inequality.

Stanoyevitch (11), in *Online Assessment in the Age of Artificial Intelligence*, examined how AI technologies and supporting platforms have impacted the integrity of online assessments, particularly in relation to rising incidences of academic dishonesty during virtual exams. Drawing on data from an introductory statistics course, the study reported a significant increase in online exam scores following the introduction of tools such as ChatGPT, despite no changes in exam difficulty or grading practices compared to pre-COVID in-person assessments.

In a complementary line of inquiry, Salinas-Navarro et al. (12), in *Designing Experiential Learning Activities with Generative Artificial Intelligence Tools for Authentic Assessment*, explored the potential of GenAI to enhance experiential learning in higher education. Their findings suggest that GenAI can support reflective thinking, hands-on learning, and the development of authentic assessment tasks. The authors emphasize, however, that to fully harness its potential, GenAI must be used responsibly, with thoughtful attention to pedagogical goals.

Similarly, Jayawardena et al. (13), in *Dental Students' Learning Experience: Artificial Intelligence vs Human Feedback on Assignments*, compared the quality of feedback provided by ChatGPT-4 and a human tutor on dental students' assignments. While students rated both sources similarly across most dimensions, they reported feeling more comfortable with human feedback. However, expert evaluations found the AI-generated feedback to be clearer and more constructive, highlighting the potential of AI tools to complement human tutors in educational settings.

This study adopts a meta-synthesis approach combined with content analysis to examine the multifaceted applications of AI in the assessment of medical students. It aims to offer a comprehensive and systematic overview of AI's role in this domain by synthesizing existing empirical findings. In doing so, the study not only highlights the opportunities presented by AI-driven assessment methods but also critically examines the challenges they pose. Ultimately, this research seeks to deepen understanding of the transformative implications of AI in medical education and to inform stakeholders' decision-making as the integration of AI into educational systems becomes increasingly inevitable.

Objectives

The primary objective of this research is to identify and analyze the applications of AI in the assessment of medical students by conducting a content analysis of existing scholarly literature in the field.

Methods

This study employed a meta-synthesis methodology, following the seven-step framework proposed by Walsh and Downe (14). This systematic approach involves the following steps: (a) framing the meta-synthesis, (b) identifying relevant studies, (c) establishing inclusion criteria, (d) appraising selected studies, (e) comparing and contrasting findings, (f) conducting reciprocal translation, and (g) synthesizing the translated concepts. This structured process ensures a rigorous and comprehensive synthesis of research findings.

Framing the Meta-Synthesis

The first step involved identifying a clear and relevant research focus to guide the inquiry. In this study, the research objective sought to uncover key themes and concepts in the existing literature on the use of AI in medical student assessment. The goal was to develop a comprehensive conceptual framework that can support further academic inquiry in this field. At this stage, the research evidence was mapped, content analysis was conducted, and the selected studies were prepared for in-depth review. This structured approach provided a foundation for identifying prevailing trends, valuable insights, and notable gaps in the current body of research.

Locating Relevant Studies, Determining Inclusion, and Appraising Quality

This stage involved a thorough literature search to identify studies relevant to the topic through electronic database searches and the collection of all potentially eligible sources. Following the systematic review framework proposed by Walsh and Downe (15), a targeted effort was made to locate all pertinent literature on the use of AI in medical student assessment.

A range of reputable academic databases was searched, including ScienceDirect, Springer, ERIC, Emerald, Sage Journals, Wiley Online Library, PubMed, and Google Scholar. The search focused on studies published between 2015 and 2024, a period selected to capture the most recent advancements in AI and its increasing integration into educational and assessment practices. These databases were chosen for their comprehensive coverage of peer-reviewed research in education, medicine, and technology, thereby ensuring access to high-quality, credible sources.

To ensure the breadth and depth of the literature search, a series of specialized keywords was employed. These included:

(Artificial intelligence AND student evaluation) OR (Artificial intelligence AND medical student evaluation) OR (Artificial intelligence AND student assessment) OR (Artificial intelligence AND medical student assessment) OR (Artificial intelligence AND feedback students) OR (Artificial intelligence AND feedback medical students) OR (ChatGPT AND student assessment) OR (ChatGPT AND medical student assessment) OR (ChatGPT AND student evaluation) OR (ChatGPT AND student appraisal) OR (ChatGPT AND medical student appraisal) OR (ChatGPT AND medical student evaluation) OR (ChatGPT AND feedback students) OR (ChatGPT AND feedback medical students**.**

These search terms were designed to capture a wide range of studies across different contexts, ensuring comprehensive coverage of AI's role in student evaluation and feedback, particularly in medical education.

To determine article eligibility, the review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The screening process was conducted in three stages: 1. title screening, 2. abstract screening, and 3. full-text screening. These stages ensured the inclusion of studies that were both relevant and methodologically sound. The overall screening process is illustrated in figure 1.

The inclusion criteria specify the conditions under which studies were included in this review, which are as follows: (a) Study design: Empirical studies employing quantitative, qualitative, or mixed-methods approaches,

as well as systematic reviews and meta-analyses, were included.

(b) Topic Relevance: The studies' focus must remain on the use of AI or ChatGPT in student evaluation, assessment, or feedback, with specific emphasis on medical student assessment or general student evaluation in educational settings, (c) Publication Period: Only studies published between 2015 and 2024 were included to capture recent trends and developments in AI applications in education, (d) Language: Only studies published in English were included due to limitations in accessing and interpreting non-English texts.

The exclusion criteria outline the conditions under which studies have been excluded from this review, which are as follows: (a) Lack of Relevance: Studies not addressing AI, ChatGPT, or student assessment and feedback in educational or medical contexts were excluded; (b) Methodological Weakness: Studies lacking methodological rigor or failing to present credible findings were excluded. (c) Duplicates: Duplicate publications or studies reporting identical data or findings were excluded. (d) Non-Peer-Reviewed Sources: Unpublished or non-peer-reviewed literature, including dissertations, conference abstracts, and grey literature, were excluded to maintain the quality and reliability of the review. The article screening process is illustrated in the figure 1.

Based on the PRISMA diagram, an initial pool of 200 sources were identified. Out of these, 98 were excluded during the title screening phase. As additional 41 sources were removed after abstract screening, and 22 were excluded following full-text screening, leaving a total of 39 sources eligible for quality assessment.

To enhance the rigor of the meta-synthesis, as researchers used an additional tool to assess the quality of the selected articles, resulting in 24 studies remaining for the final analysis. Each researcher independently reviewed and completed the evaluation checklists based on predefined quality criteria. After this individual assessment, the results were compared and discussed among all team members. Any discrepancies in scoring or interpretation were carefully examined, and consensus was reached through discussions or, if necessary, by consulting a third expert. This collaborative approach would ensure reliability, reduce bias, and enhance the overall validity of the quality assessment process.

In the final appraisal step, studies were evaluated based on sample quality criteria from Atkins et al., (16) and low-quality studies were excluded to enhance the rigor of the meta-synthesis process. Although the focus of the review was initially on qualitative research, the limited availability of relevant studies warranted the inclusion of quantitative and mixed methods designs that met the inclusion and quality criteria. The inclusion criteria prioritized studies with clearly articulated research questions, a well-justified methodological approach, and adequate contextual descriptions, including researcher positioning and sampling strategies. Data collection methods were required to be thoroughly documented and aligned with the research objective. Similarly, data analysis procedures needed to be explicitly outlined, logically connected to the research questions, and supported by sufficient evidence. Based on these criteria, 24 articles were selected for the final meta-synthesis. To ensure alignment with the study's objective, a purposive sampling strategy was employed during the screening process. In table 1, the bibliographic details of the selected studies are provided, including the reference number, names of the researchers, year, and title.

Comparing and Contrasting Findings

The purpose of this stage was to identify and categorize the various applications of AI in the assessment of medical students. To accomplish this, the included studies were examined through a detailed review of their titles, key concepts, and content. This comparative analysis allowed the researchers to systematically explore the range and nature of AI applications. Table 2 presents a comparative overview of the selected studies, organized by specific application areas of AI in medical student assessment.

Reciprocal Translation

In the next phase, thematic coding was employed to identify key concepts and recurring patterns across the selected studies. This process involved the development of main themes, subthemes, and codes through a reciprocal translation approach. As defined by Noblit and Hare (41), reciprocal translation refers to the inductive and interpretive emergence of concepts and metaphors through iterative comparison and classification of themes across studies.

Following this approach, relevant themes were synthesized by compiling and interrelating them across the data set. This method was selected for its appropriateness

and practicality in capturing the nuanced similarities and differences among studies. The final thematic categories included: (a) feedback applications, (b) online exam applications, (c) instrument design applications, (d) applications in the assessment process, (e) applications in student learning management, and (f) applications in faculty workload management.

Key excerpts from the selected articles were compiled into a Word document and thoroughly re-read multiple times by the researchers to foster a deep engagement with the data. The sentence was selected as the unit of analysis, and key concepts were extracted based on their semantic density. These concepts were then grouped into subthemes according to their conceptual similarities. Subthemes were further refined and merged into broader, more abstract categories to form the main themes.

Synthesis of Translations

The final step of the meta-synthesis involved synthesizing the translated and reconsolidated concepts and themes into an overarching framework. This stage aimed to construct a qualitative conceptual model that captured the core applications of AI in the assessment of medical students. The synthesis process involved proposing a general interpretation of the phenomenon that integrated the themes, codes, and categories derived from the prior phases of analysis.

To ensure the credibility and rigor of the research, several quality assurance measures were implemented in line with recognized standards for qualitative research validity. Drawing on Whittemore et al. (42), who synthesized 13 scholarly reports on qualitative validity, ten indicators of research quality were applied across four main criteria and six sub-criteria:

- *Credibility:* The researchers achieved coding consensus through multiple iterative rounds of peer review, ensuring that data interpretation was accurate and supported by all members of the research team. Triangulation of perspectives enhanced the trustworthiness of the findings.
- *Authenticity:* Efforts were made to accurately reflect the perspectives of the original authors in the selected studies. Direct attention was given to preserving diverse viewpoints and ensuring that interpretations remained true to the intent and context of each source.
- *Criticality:* A reflective and analytical stance was maintained throughout the study. Researchers actively questioned assumptions considered underlying power dynamics, and critically examined the roles of various actors (e.g., students, faculty, assessment systems) to offer a deeper understanding of the phenomena.
- *Integrity:* The research process was marked by transparency and consistency. An audit trail was maintained, and team members collaboratively engaged in all stages—from article selection to data synthesis—ensuring methodological coherence and ethical alignment.
- *Ethical Rigor:* Ethical considerations were embedded throughout the research process, from article selection to reporting. The team prioritized respect for original sources, avoided misrepresentation, and remained sensitive to the implications of interpreting others' work.
- *Methodological Congruence:* The study demonstrated strong alignment between the research objective, inclusion criteria, and analytical strategies. This coherence ensured that the findings were both methodologically sound and directly relevant to the study's purpose.
- *Creativity:* The development of a novel categorization of AI applications in student assessment reflected the study's innovative contribution. This framework addressed gaps in the literature and provided a fresh lens for future research and practice.
- *Analytical Depth:* The synthesis process yielded nuanced and detailed insights into the themes and patterns emerging from the selected studies. Through deep engagement with the data, the study moved beyond surface-level coding to offer meaningful interpretations.
- *Contextualization:* The findings were interpreted with careful attention to the specific social, educational, and institutional contexts of the original studies. This approach ensured relevance across diverse settings and strengthened the applicability of the results.

These rigorous procedures, grounded in Whittemore et al.'s indicators of research quality, contributed to establishing the validity and reliability of the research process, ensuring that it was both methodologically robust and ethically sound.

To further verify the reliability of the findings, a test-retest strategy was employed for assessing coding consistency. In this approach, all extracted key concepts (codes) were re-categorized by the same researcher after

a 20-day interval. This method evaluates the stability of the categorization process by comparing the consistency of code assignments over time. Concepts that were labeled identically across both coding sessions were counted as "agreements," while discrepancies were labeled as "disagreements." The frequency of agreement and disagreement was then used to calculate the overall reliability score. In this study, 301 concepts were extracted in total, and 135 showed consistent labeling between the two coding sessions. The resulting test-retest reliability was calculated at 89%, which exceeds the commonly accepted threshold of 60%, thereby confirming the stability and internal consistency of the coding process.

$$\text{Test-retest Reliability Percentage} = \frac{135 * 2}{301} * 100$$

Results

To address the main research objective, the extracted key concepts were integrated and categorized based on their similarities and differences. This process resulted in the identification of 6 main themes and 19 sub-themes related to the applications of AI in medical student assessment. These themes are presented in the table 3:

As shown in the table 3, the applications of AI in medical student assessment are diverse and span across a range of domains. The findings highlight the transformative potential of AI in reshaping how assessment is conceptualized, implemented, and managed in medical education. An analysis of the frequency of coded concepts under each main theme revealed the following statistics:

- Mean frequency: 24.17 coded concepts per sub-theme
- Minimum frequency: 9 concepts (in the "Instrument Design Applications" theme)

Maximum frequency: 43 concepts (in the "Applications in the Assessment Process" theme)

Figure 2 presents a visualization that illustrates the relative frequency of each main theme, providing a visual representation of the emphasis placed on different AI applications.

A schematic model of the research findings is presented below to summarize and conceptualize the thematic structure derived from the synthesis.

Discussion

This section analyzes the study's findings through the lens of the six main themes identified, each representing a key area where AI is transforming student assessment. These six main themes are depicted in Figure 3.

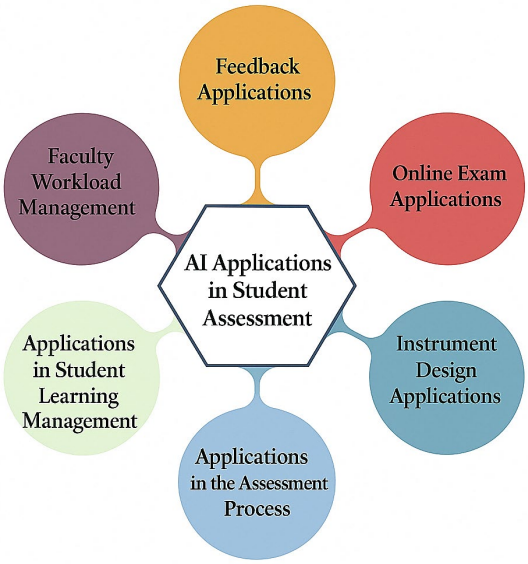

Figure 3. Schematic model of research findings

Feedback Applications

Feedback is broadly conceptualized as information that serves two essential functions: (a) identifying students' current performance levels and (b) guiding them toward their learning goals by outlining how to progress from point A to point B (43). Effective feedback is pivotal to student learning as it helps learners recognize their achievements and address performance gaps, ultimately fostering academic motivation and a sense of self-efficacy (44).

Hattie and Timperley (45) identified four distinct types of feedback: (a) task, (b) process, (c) self-regulation, and (d) self-feedback. Each serves a different purpose and exerts varying levels of influence on student learning. Consequently, implementing effective feedback strategies requires an understanding of these differences. Providing feedback on students' performance remains a fundamental component of teaching and learning. Instructors invest considerable time and effort into offering meaningful feedback, which plays a vital role in shaping students' academic progress by highlighting both their strengths and areas for improvement. When delivered appropriately, feedback enhances students' sense of responsibility for their learning and motivates them to strive toward their educational goals.

With the rise of AI, feedback practices are being redefined. AI-powered tools facilitate the delivery of

intelligent, automated, and timely feedback that is closely aligned with students' performance. Moreover, these systems can generate comparative and differentiated feedback tailored to various student groups, thereby supporting more personalized learning experiences. The findings of this review reflect these developments and align with existing literature (17, 19, 20, 23, 24, 27-29, 33, 34, 36, 39), as well as other studies (46-48) that examine the role of AI in enhancing feedback within the teaching and learning process.

Online Exam Applications

Online exams have emerged as a vital tool for assessing student performance, especially in the wake of the COVID-19 pandemic. Compared to traditional assessments, they offer enhanced flexibility and support a range of assessment formats, making them particularly suitable for both diagnostic and formative evaluations (3). Online exams typically incorporate diverse question types, including multiple-choice, true/false, matching, sequencing, fill-in-the-blank, and essay responses. These exams are created using specialized software designed to evaluate students' performance across various learning dimensions. It is important to distinguish online exams from computer-based assessments (CBAs). While both utilize digital platforms, CBAs are typically conducted using specific software installed on standalone devices, independent of internet connectivity (49). In contrast, online exams rely on networked systems and often integrate learning management platforms.

As digitalization continues to reshape educational practices, online examinations are expected to become even more prominent—potentially replacing traditional paper-based tests altogether. The integration of AI in online exam systems further enhances their functionality. AI enables the design of dynamic, personalized assessments tailored to individual students' needs, interests, and ability levels. This level of customization provides more nuanced and realistic data for evaluating students' competencies and identifying both strengths and areas for growth. Moreover, AI-powered grading systems automate the evaluation process, reducing the likelihood of human error and enhancing fairness, accuracy, and efficiency—particularly valuable when assessing large cohorts of students. The findings related to this theme are consistent with previous research (18, 20, 21, 23, 24, 29) and further supported by other studies examining AI applications in assessment contexts (50-52).

Instrument Design Applications

Assessment instruments are foundational to effective teaching and learning, serving as essential tools for evaluating student performance and guiding instructional decisions. Well-designed instruments enable faculty to accurately measure learning outcomes, identify students' strengths and weaknesses, and ensure alignment between assessment tasks and educational objectives. Beyond individual evaluation, they offer valuable data to inform curriculum development and support the continuous refinement of teaching strategies and course content. In the context of medical education, recent research has highlighted the limitations of many current assessment instruments, emphasizing the urgent need for redesign and modernization to better reflect evolving competencies, clinical demands, and educational goals (53). The findings of the present review echo these concerns in alignment with previous literature (18, 28, 32, 33), reinforcing the call for continuous innovation in assessment design. In this regard, AI plays an increasingly important role in offering tools to support the development of more dynamic, data-driven, and personalized assessment instruments

Applications in the Assessment Process

Assessment should be strategically employed to enhance teaching and learning by sending clear signals to students about what knowledge and skills they should prioritize. When implemented effectively, assessment acts as a bridge between instruction and learning, guiding both educators and learners toward meaningful educational outcomes. To accurately evaluate the learning process, it is essential to incorporate both subjective perceptions—those of students and educators—and direct indicators such as exam scores and analytic rubrics (54). This dual perspective ensures that assessment not only reflects academic achievement but also captures the lived experience of learning. Assessment plays a multifaceted role in education. Beyond simply measuring performance, it monitors students' cognitive, affective, and psychomotor development, thereby supporting individual growth and institutional accountability. It also serves as a mechanism to support academic mobility, promote learner autonomy, and improve the overall quality of education by offering continuous feedback on student progress. Through regular assessment, both students and faculty can track developmental trajectories and

make informed adjustments to teaching and learning strategies.

Among the various forms of assessment, authentic assessment stands out as a particularly valuable approach. It evaluates learning through sustained, real-world tasks that mirror professional and academic contexts. Unlike one-time tests, authentic assessment emphasizes ongoing performance and development over time, providing richer, more nuanced insights into students' learning processes and outcomes (55). As such, the evaluation of teaching and learning requires a systematic approach—one that integrates data collection, analysis, and interpretation into a coherent and reflective cycle of improvement. In recent years, advances in AI have further enhanced assessment practices. AI technologies offer powerful tools for tracking student progress longitudinally, predicting future academic outcomes, and improving the precision and reliability of assessments. By minimizing human error and reducing potential bias, AI fosters a more equitable evaluation process. Furthermore, AI systems can analyze emotional and behavioral data, offering educators deeper insights into student engagement and well-being, which are critical yet often overlooked aspects of academic success.

The findings of the present review echo a growing body of literature (17-20, 22, 32, 35, 39, 40) and are consistent with prior research (56, 59) on the transformative role of AI in educational assessment. Several empirical studies have demonstrated how AI can support early identification of learning difficulties and enable timely interventions. For example, Pande (60) used AI algorithms to analyze various determinants of academic success, including age, parental education, occupation, and student health. The Support Vector Machine (SVM) model achieved a precision rate of 84.37%, highlighting AI's capacity to synthesize complex data for predictive purposes. Similarly, Jiao et al. (61) identified class participation, knowledge acquisition, and overall performance as key predictors of academic success, which were effectively modeled using AI techniques. Haron et al. (62) employed the RepTree algorithm to classify students into high- and low-risk categories based on predicted academic outcomes, enabling targeted support. In another study, Wazir et al. (63) explored how time management, study habits, and collaborative learning contributed to academic performance. Their AI-driven models not only detected at-risk students early but also facilitated interventions that reduced dropout rates by 25%. Together, these studies underscore the growing relevance of AI-enhanced assessment systems in fostering more adaptive, data-informed, and student-centered learning environments.

Student Learning Management Applications

AI in student assessment helps learners choose more effective and personalized educational pathways by more accurately evaluating their abilities, learning styles, and individual characteristics. AI-driven assessment systems offer a personalized and adaptive approach that promotes learner autonomy, fosters self-directed learning, and enriches the overall educational experience (64). One particularly impactful application of AI in medical education is its role in fostering the development of self-regulated learning (SRL) skills. SRL is widely recognized as a key determinant of academic success, as it enables students to set specific goals, monitor their progress, and implement strategies to achieve desired outcomes (65).

AI-based assessment systems contribute to this process by delivering personalized and timely feedback derived from the analysis of students' behavioral and performance data. This feedback supports learners in setting meaningful goals, tracking their development, and selecting effective strategies to enhance their academic performance.

In addition, AI-driven assessments assist students in gaining a deeper understanding of their learning processes, strengths, and areas for improvement. By recommending tailored educational resources and strategies, these systems help learners identify personalized development paths and support the achievement of individual learning objectives. Furthermore, through continuous monitoring and analysis of student progress, AI systems can guide learners toward ongoing improvement and sustained academic growth. The findings related to this theme are consistent with a growing body of literature emphasizing the role of AI in supporting student learning management (17-20, 23, 28, 29, 31-33, 37, 38). They also align with prior studies (66-69) that underscore the potential of AI applications in managing and enhancing student learning experiences.

Faculty Workload Management Applications

AI-based assessment systems also offer significant advantages for faculty members, notably in reducing workload and streamlining student evaluation tasks. For full-time faculty, maintaining a balanced workload is

essential—not only to foster innovation within and beyond the classroom but also to prevent burnout and allow time for creative, research-driven contributions (70). By automating the analysis of tests, assignments, and other forms of assessment, AI tools can handle tasks that traditionally demand considerable time and energy. Moreover, these systems can generate immediate, personalized feedback for students, minimizing the need for repetitive, manual grading and enhancing the overall efficiency of the assessment process.

This technological support enables educators to devote more attention to instructional quality and student engagement. Another important function of AI in faculty development is its ability to inform and refine teaching strategies. By analyzing patterns in student performance, learning behaviors, and areas of difficulty or strength, AI can provide actionable insights that help educators adjust their methods to better meet learners' needs. In doing so, teaching becomes more responsive, dynamic, and personalized—contributing to more effective learning outcomes. The findings related to this theme are consistent with those of other studies (17-20, 22-24, 26, 28-30, 33-40) and supported by additional research highlighting the potential of AI to assist faculty in assessment and instruction (71-74). A comparative and analytical summary of traditional versus AI-based assessment methods for students is presented in table 4, reflecting the implications drawn from these findings.

Limitations: its strengths, the meta-synthesis approach employed in this study presents several limitations. First, because it relies exclusively on existing literature, there is a risk that some relevant or recently published studies may have been inadvertently excluded, potentially limiting the breadth and comprehensiveness of the findings? Second, the methodological heterogeneity of the included studies posed challenges for synthesis. Variations in research design, data collection techniques, and analytical approaches may have led to divergent interpretations of similar phenomena, complicating the effort to draw cohesive and universally applicable conclusions.

Third, the generalizability of the findings is constrained by the specific educational and cultural contexts in which the included studies were conducted. As a result, the insights derived may not be directly transferable to other settings with different institutional structures or student populations. Finally, the potential for researcher bias must be acknowledged. Although clear inclusion criteria were applied throughout the review process, subjective judgments during study selection and thematic synthesis may have unintentionally favored literature aligned with the researchers' theoretical orientations, potentially influencing the neutrality and objectivity of the analysis.

Future Research Directions: To advance the field, future research is encouraged to adopt diverse methodological approaches that address both the technical and ethical dimensions of AI in medical student assessment. First, experimental and quasi-experimental designs are essential for conducting comparative analyses between traditional and AI-based assessment methods. Such studies would enable researchers to rigorously evaluate the accuracy, efficiency, and educational impact of AI tools relative to conventional practices. Second, qualitative research methods are needed to investigate the ethical implications of using AI in assessment, including concerns about transparency, fairness, accountability, and the potential depersonalization of learner evaluation. These methods can provide rich, contextual insights into the experiences and perceptions of students, educators, and other stakeholders. Finally, a mixed-methods approach is recommended for the development and evaluation of innovative assessment tools that integrate AI into the evaluation of clinical competencies. Combining quantitative performance data with qualitative feedback would ensure that these tools are both pedagogically sound and ethically responsible, ultimately contributing to more effective and equitable medical education practices.

Conclusion

This study highlighted the transformative impact of AI on medical student assessment, emphasizing its role in shaping education, research, and social services within medical universities. By identifying six key themes through content analysis, the research provided a comprehensive understanding of AI's potential in this domain. These themes included feedback applications, online exam applications, instrument design applications, applications in the assessment process, applications in student learning management, and applications in faculty workload management.

The findings underscored the substantial advantages AI offers in enhancing assessment practices for both students and faculty members. For students, AI promotes the development of self-regulated learning by enabling personalized goal setting, performance

tracking, and strategy adoption. It also supports deeper insight into students' strengths, weaknesses, and learning processes by offering timely and individualized feedback and recommendations. For faculty, AI facilitates assessment tasks, reduces repetitive grading, and provides real-time insights that can inform instructional strategies. It enables educators to tailor their teaching methods and styles based on students' learning patterns and needs, thereby improving the overall quality of education.

However, despite its advantages and various applications, AI can lead to negative consequences and numerous ethical challenges if used irresponsibly. One of the key ethical concerns is algorithmic bias, as AI systems may reflect racial prejudices and gender biases embedded in their training data (75). Another serious concern involves privacy issues, particularly regarding access and security of student data (76). Ensuring the validity and reliability of AI in education demands a high level of accuracy and consistency. Although AI systems are designed to provide objective results, they have not yet reached the adaptability and nuanced understanding of human intelligence. Moreover, the quality of data used in AI systems must be closely monitored and regulated to ensure accurate outcomes (77). Another important challenge lies in data governance, which encompasses the collection, organization, control, usage, storage, archiving, and destruction of data. The implementation of data governance must be guided by structured frameworks, supported by institutional policies and procedures, and communicated effectively through leadership and management (78).

The cost of implementing AI systems also represents a major barrier across various sectors, including education, healthcare, and industry. These costs include the initial investment in developing hardware and software infrastructure, expenses related to processing and storing large volumes of data, and the cost of hiring and training specialized personnel. Additionally, ongoing system maintenance and updates are necessary to ensure accuracy and efficiency, creating further financial pressure on organizations. As a result, many institutions may be unable to adopt AI due to financial constraints, potentially increasing inequality in access to the benefits of this technology. Therefore, developing more cost-effective models, utilizing cloud services, and introducing supportive policies can help reduce these costs and improve institutional access to AI. The findings of this review emphasize the need for a strategic approach to AI integration in education, one that maximizes its benefits while addressing ethical, technical, and financial challenges. Effective adaptation to AI-driven changes will strengthen medical education and enhance student assessment, ultimately contributing to improved healthcare outcomes.

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References

1. Jafari F, Keykha A. Identifying the opportunities and challenges of artificial intelligence in higher education: a qualitative study. Journal of Applied Research in Higher Education. 2024 Jul 9;16(4):1228-45. doi:10.1108/JARHE-09-2023-0426.
2. Keykha A, Behravesh S, Ghaemi F. ChatGPT and medical research: a meta-synthesis of opportunities and challenges. J Adv Med Educ Prof. 2024 Jul 1;12(3):135-147. doi: 10.30476/JAMP.2024.101068.1910. [PMID: 39175584] [PMCID: PMC11336189]
3. Keykha A, Imanipour M, Shahrokhi J, Amiri M. The advantages and challenges of electronic exams: qualitative research based on Shannon Entropy Technique. J Adv Med Educ Prof. 2025 Jan 1;13(1):1-11. doi: 10.30476/jamp.2024.102951.1987. [PMID: 39906078] [PMCID: PMC11788768]
4. Rutherford S, Pritchard C, Francis N. Assessment IS learning: developing a student-centered approach for assessment in Higher Education. FEBS Open Bio. 2025 Jan;15(1):21-34. doi: 10.1002/2211-5463.13921. [PMID: 39487560] [PMCID: PMC11705397]
5. Serhani MA, Bouktif S, Al-Qirim N, El Kassabi HT. Automated system for evaluating higher education programs. Education and Information Technologies. 2019; 24:3107-28. doi:10.1007/s10639-019-09910-6.
6. Fui-Hoon Nah F, Zheng R, Cai J, Siau K, Chen L. Generative AI and ChatGPT: applications, challenges, and AI-human collaboration. Journal of Information Technology Case and Application Research. 2023 Jul 3;25(3):277-304. doi:10.1080/15228053.2023.2233814.
7. Wang N, Wang X, Su YS. Critical analysis of the technological affordances, challenges and future directions of Generative AI in

education: a systematic review. Asia Pacific Journal of Education. 2024 Jan 2;44(1):139-55. doi:10.1080/02188791.2024.2305156.
8. Dawson P. Defending assessment security in a digital world: preventing e-cheating and supporting academic integrity in higher education. Abingdon, UK: Routledge; 2021. doi:10.4324/9780429324178.
9. Perkins M, Furze L, Roe J, MacVaugh J. The Artificial Intelligence Assessment Scale (AIAS): a framework for ethical integration of generative AI in educational assessment. Journal of University Teaching and Learning Practice. 2024 May;21(6):49-66. doi:10.53761/q3azde36.
10. Mahamuni AJ, Tonpe SS. Enhancing educational assessment with artificial intelligence: challenges and opportunities. Proceedings of the International Conference on Knowledge Engineering and Communication Systems (ICKECS); 2024 Aug 7; Chikkaballapur, India. 2024:1-5. doi: 10.1109/ICKECS61492.2024.10616620.
11. Stanoyevitch A. Online assessment in the age of artificial intelligence. Discover Education. 2024 Aug 19;3(1):126. doi:10.1007/s44217-024-00212-9.
12. Salinas-Navarro DE, Vilalta-Perdomo E, Michel-Villarreal R, Montesinos L. Designing experiential learning activities with generative artificial intelligence tools for authentic assessment. Interactive Technology and Smart Education. 2024 Oct 30;21(4):708-34. doi:10.1108/ITSE-12-2023-0236.
13. Jayawardena CK, Gunathilake Y, Ihalagedara D. Dental students' learning experience: artificial intelligence vs human feedback on assignments. Int Dent J. 2025 Feb;75(1):100-108. doi: 10.1016/j.identj.2024.12.022. [PMID: 39799065] [PMCID: PMC11806320]
14. Walsh D, Downe S. Meta-synthesis method for qualitative research: a literature review. J Adv Nurs. 2005 Apr;50(2): 204-11. doi: 10.1111/j.1365-2648.2005.03380.x. [PMID: 15788085]
15. Walsh D, Downe S. Appraising the quality of qualitative research. Midwifery. 2006 Jun; 22(2): 108-19. doi: 10.1016/j.midw.2005.05.004. [PMID: 16243416]
16. Atkins S, Lewin S, Smith H, Engel M, Fretheim A, Volmink J. Conducting a meta-ethnography of qualitative literature: lessons learnt. BMC Med Res Methodol. 2008 Apr 16:8:21. doi: 10.1186/1471-2288-8-21. [PMID: 18416812] [PMCID: PMC2374791]
17. Lee AV. Supporting students' generation of feedback in large-scale online course with artificial intelligence-enabled evaluation. Studies in Educational Evaluation. 2023;77:101250. doi:10.1016/j.stueduc.2023.101250.
18. Swiecki Z, Khosravi H, Chen G, Martinez-Maldonado R, Lodge JM, Milligan S, et al. Assessment in the age of artificial intelligence. Computers and Education: Artificial Intelligence. 2022;3:100075. doi: 10.1016/j.caeai.2022.100075.
19. Maier U, Klotz C. Personalized feedback in digital learning environments: Classification framework and literature review. Computers and Education: Artificial Intelligence. 2022;3:100080. doi:10.1016/j.caeai.2022.100080.
20. Yildirim-Erbasli SN, Bulut O. Conversation-based assessment: A novel approach to boosting test-taking effort in digital formative assessment. Computers and Education: Artificial Intelligence. 2023;4:100135. doi:10.1016/j.caeai.2023.100135.
21. Smerdon D. AI in essay-based assessment: student adoption, usage, and performance. Computers and Education: Artificial Intelligence. 2024;7:100288. doi:10.1016/j.caeai.2024.100288.
22. Martínez-Comesanã M, Rigueira-Díaz X, Larrañaga-Janeiro A, Martínez-Torres J, Ocarranza-Prado I, Kreibel D. Impact of artificial intelligence on assessment methods in primary and secondary education: systematic literature review. Revista de Psicodidáctica (English ed.). 2023; 28(2): 93-103. doi:10.1016/j.psicoe.2023.06.002.
23. Memarian B, Doleck T. A review of assessment for learning with artificial intelligence. Computers in Human Behavior: Artificial Humans. 2024 Jan 1; 2(1): 100040. doi: 10.1016/j.chbah.2023.100040.
24. Tonbuloğlu B. An evaluation of the use of artificial intelligence applications in online education. Journal of Educational Technology and Online Learning. 2023; 6(4): 866-84. doi:10.31681/jetol.1335906.
25. González-Calatayud V, Prendes-Espinosa P, Roig-Vila R. Artificial intelligence for student assessment: a systematic review. Applied sciences. 2021 Jun 12; 11(12): 5467. doi:10.3390/app11125467.
26. Casey D. ChatGPT in public policy teaching and assessment: an examination of opportunities and challenges. Aust J Publ Admin. 2024;1-15. doi:10.1111/1467-8500.12647.
27. Lu Q, Yao Y, Xiao L, Yuan M, Wang J, Zhu X. Can ChatGPT effectively complement teacher assessment of undergraduate students' academic writing? Assessment & Evaluation in Higher Education. 2024; 49(5): 616-33. doi:10.1080/02602938.2024.2301722.
28. Williams P. AI, Analytics and a new assessment model for universities. Education Sciences. 2023 Oct 17;13(10):1040. doi:10.3390/educsci13101040.
29. Salinas-Navarro DE, Vilalta-Perdomo E, Michel-Villarreal R, Montesinos L. Using generative artificial intelligence tools to explain and enhance experiential learning for authentic assessment. Education Sciences. 2024 Jan 12;14(1):83. doi:10.3390/educsci14010083.
30. Lynam S, Cachia M. Students' perceptions of the role of assessments at higher education. Assessment & Evaluation in Higher Education. 2018 Feb 17; 43(2): 223-34. doi:10.1080/02602938.2017.1329928.
31. Fahmy Y. Student perception on AI-driven assessment: motivation, engagement and feedback capabilities (Dissertation). Enschede, Netherlands: University of Twente; 2023.
32. Koh E, Doroudi S. Learning, teaching, and assessment with generative artificial intelligence: towards a plateau of productivity. Learning: Research and Practice. 2023 Jul 3;9(2):109-16. doi:10.1080/23735082.2023.2264086.
33. Hooda M, Rana C, Dahiya O, Rizwan A, Hossain MS. Artificial intelligence for assessment and feedback to enhance student success in higher education. Mathematical Problems in Engineering. 2022;2022(1):5215722. doi:10.1155/2022/5215722.
34. Zirar A. Exploring the impact of language models, such as ChatGPT, on student learning and assessment. Review of Education. 2023 Dec;11(3):e3433. doi:10.1002/rev3.3433.
35. Mao J, Chen B, Liu JC. Generative artificial intelligence in education and its implications for assessment. Tech Trends. 2024 Jan;68(1):58-66. doi:10.1007/s11528-023-00911-4.
36. Kooli C, Yusuf N. Transforming educational assessment: insights into the use of ChatGPT and large language models in grading. International Journal of Human–Computer Interaction. 2024; 41(5):1-2. doi:10.1080/10447318.2024.2338330.
37. Chaudhry IS, Sarwary SA, El Refae GA, Chabchoub H. Time to revisit existing student's performance evaluation approach in higher education sector in a new era of ChatGPT—a case study. Cogent Education. 2023 Dec 31; 10(1): 2210461. doi:10.1080/2331186X.2023.2210461.
38. Ouyang F, Dinh TA, Xu W. A systematic review of AI-driven

educational assessment in STEM education. Journal for STEM Education Research. 2023 Dec; 6(3): 408-26. doi:10.1007/s41979-023-00112-x.
39. Xia Q, Weng X, Ouyang F, Lin TJ, Chiu TK. A scoping review on how generative artificial intelligence transforms assessment in higher education. International Journal of Educational Technology in Higher Education. 2024 May 24;21(1): 40. doi:10.1186/s41239-024-00468-z.
40. Fuller KA, Morbitzer KA, Zeeman JM, Persky A M, Savage A C, McLaughlin JE. Exploring the use of ChatGPT to analyze student course evaluation comments. BMC Med Educ. 2024 Apr 19;24(1):423. doi: 10.1186/s12909-024-05316-2. [PMID: 38641798] [PMCID: PMC11031883]
41. Noblit GW, Hare RD. Meta-ethnography: synthesizing qualitative studies. Newbury Park, CA: Sage Publications; 1988. doi:10.4135/9781412985000.
42. Whittemore R, Chase SK, Mandle CL. Validity in qualitative research. Qual Health Res. 2001 Jul;11(4):522-37. doi: 10.1177/104973201129119299. [PMID: 11521609]
43. Van der Kleij FM, Lipnevich AA. Student perceptions of assessment feedback: a critical scoping review and call for research. Educational assessment, evaluation and accountability. 2021;33:345-73. doi:10.1007/s11092-020-09331-x.
44. Hill J, West H. Improving the student learning experience through dialogic feed-forward assessment. Assessment & Evaluation in Higher Education. 2020; 45(1): 82-97. doi:10.1080/02602938.2019.1608908.
45. Hattie J, Timperley H. The power of feedback. Review of Educational Research. 2007; 77(1): 81-112. doi:10.3102/003465430298487.
46. Xu W, Meng J, Raja SK, Priya MP, Kiruthiga Devi M. Artificial intelligence in constructing personalized and accurate feedback systems for students. International Journal of Modeling, Simulation, and Scientific Computing. 2023 Feb 22;14(1):2341001. doi:10.1142/S1793962323410015.
47. Ma X. English teaching in artificial intelligence-based higher vocational education using machine learning techniques for students' feedback analysis and course selection recommendation. Journal of Universal Computer Science. 2022 Sep 1;28(9):898. doi:10.3897/jucs.94160.
48. Meyer J, Jansen T, Schiller R, Liebenow LW, Steinbach M, Horbach A, et al. Using LLMs to bring evidence-based feedback into the classroom: AI-generated feedback increases secondary students' text revision, motivation, and positive emotions. Computers and Education: Artificial Intelligence. 2024;6:100199. doi:10.1016/j.caeai.2023.100199.
49. Ahmed FR, Ahmed TE, Saeed RA, Alhumyani H, Abdel-Khalek S, Abu-Zinadah H. Analysis and challenges of robust E-exams performance under COVID-19. Results Phys. 2021 Apr:23:103987. doi: 10.1016/j.rinp.2021.103987. [PMID: 36338375] [PMCID: PMC9616684]
50. Susnjak T, McIntosh TR. ChatGPT: The end of online exam integrity? Education Sciences. 2024;14(6):656. doi: 10.3390/educsci14060656.
51. Newton P, Xiromeriti M. ChatGPT performance on multiple choice question examinations in higher education. A pragmatic scoping review. Assessment & Evaluation in Higher Education. 2024; 49(6):781-98. doi:10.1080/02602938.2023.2299059.
52. Sumbal A, Sumbal R, Amir A. Can ChatGPT-3.5 pass a medical exam? A systematic review of ChatGPT's performance in academic testing. J Med Educ Curric Dev. 2024 Mar 13:11:23821205241238641. doi: 10.1177/23821205241238641. [PMID: 38487300] [PMCID: PMC10938614]
53. Passeri S, Li LM, Nadruz Jr W, Bicudo AM. Medical students progress in the practice assessment of knowledge, skills, and attitudes. Creative Education. 2015; 6(08): 805. doi:10.4236/ce.2015.68084.
54. Preston R, Gratani M, Owens K, Roche P, Zimanyi M, Malau-Aduli B. Exploring the impact of assessment on medical students' learning. Assessment & Evaluation in Higher Education. 2020;45(1):109-24. doi:10.1080/02602938.2019.1614145.
55. Maison M, Darmaji D, Astalini A, Perdana R. Supporting assessment in education: e-assessment interest in physics. Universal Journal of Educational Research. 2020;8(1):89-97. doi:10.13189/ujer.2020.080110.
56. Rudolph J, Tan S, Tan S. ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? Journal of applied learning and teaching. 2023 Jan 25; 6(1): 342-63. doi:10.37074/jalt.2023.6.1.9.
57. Hopfenbeck TN. The future of educational assessment: self-assessment, grit and ChatGPT?. Assessment in Education: Principles, Policy & Practice. 2023 Mar 4;30(2):99-103. doi:10.1080/0969594X.2023.2212192.
58. Gamage KA, Dehideniya SC, Xu Z, Tang X. ChatGPT and higher education assessments: more opportunities than concerns? Journal of Applied Learning and Teaching. 2023;6(2): 358-69. doi:10.37074/jalt.2023.6.2.32.
59. Kolade O, Owoseni A, Egbetokun A. Is AI changing learning and assessment as we know it? Evidence from a ChatGPT experiment and a conceptual framework. Heliyon. 2024 Feb 10;10(4):e25953. doi: 10.1016/j.heliyon.2024.e25953. [PMID: 38379960] [PMCID: PMC10877295]
60. Pande SM. Machine learning models for student performance prediction. In Proceedings of the 2023 International Conference on Innovative Data Communication Technologies and Application (ICIDCA); 2023 Mar 14; Coimbatore, India. Piscataway, NJ: IEEE; 2023: 27-32. doi: 10.1109/ICIDCA56705.2023.10099503.
61. Jiao P, Ouyang F, Zhang Q, Alavi AH. Artificial intelligence-enabled prediction model of student academic performance in online engineering education. Artificial Intelligence Review. 2022 Dec;55(8):6321-44. doi:10.1007/s10462-022-10155-y.
62. Haron NH, Mahmood R, Amin NM, Ahmad A, Jantan SR. An artificial intelligence approach to monitor and predict student academic performance. Journal of advanced research in applied sciences and engineering technology. 2024;44(1):105-19. doi:10.37934/araset.44.1.105119.
63. Wazir S, Mohani SS, Affandi H, Rafique AA, Soomro M. Impact of artificial intelligence and machine learning on predicting student performance and engagement. Dialogue Social Science Review (DSSR). 2025;3(1):1298-311.
64. Pratama MP, Sampelolo R, Lura H. Revolutionizing education: harnessing the power of artificial intelligence for personalized learning. Klasikal: Journal of education, language teaching and science. 2023; 5(2):350-7. doi:10.52208/klasikal.v5i2.877.
65. Jin SH, Im K, Yoo M, Roll I, Seo K. Supporting students' self-regulated learning in online learning using artificial intelligence applications. International Journal of Educational Technology in Higher Education. 2023;20(1):37. doi: 10.1186/s41239-023-00406-5.
66. Fauzi F, Tuhuteru L, Sampe F, Ausat AM, Hatta HR. Analysing the role of ChatGPT in improving student productivity in higher education. Journal on Education. 2023;5(4):14886-91. doi:10.31004/joe.v5i4.2563.

67. Rawas S. ChatGPT: Empowering lifelong learning in the digital age of higher education. Education and Information Technologies. 2024;29(6):6895-908. doi:10.1007/s10639-023-12114-8.
68. Monib WK, Qazi A, Mahmud MM. Exploring learners' experiences and perceptions of ChatGPT as a learning tool in higher education. Education and Information Technologies. 2025: 30(1): 917-39. doi:10.1007/s10639-024-13065-4.
69. Abas MA, Arumugam SE, Yunus MM, Rafiq KR. ChatGPT and personalized learning: opportunities and challenges in higher education. International Journal of Academic Research in Business and Social Sciences. 2023;13(12): 3536-45. doi:10.6007/IJARBSS/v13-i12/20240.
70. Griffith AS, Altinay Z. A framework to assess higher education faculty workload in US universities. Innovations in Education and Teaching International. 2020; 57(6): 691-700. doi:10.1080/14703297.2020.1786432.
71. Cambra-Fierro JJ, Blasco MF, López-Pérez ME, Trifu A. ChatGPT adoption and its influence on faculty well-being: an empirical research in higher education. Education and Information Technologies. 2024;30:1517-38. doi:10.1007/s10639-024-12871-0.
72. Sun GH, Hoelscher SH. The ChatGPT storm and what faculty can do. Nurse Educ. 2023 May-Jun;48(3):119-124. doi: 10.1097/NNE.0000000000001390. [PMID: 37043716]
73. Nikoçeviq-Kurti E, Bërdynaj-Syla L. ChatGPT integration in higher education: impacts on teaching and professional development of university professors. Educational Process: International Journal. 2024; 13(3): 22-39. doi:10.22521/edupij.2024.133.2.
74. Cross J, Robinson R, Devaraju S, Vaughans A, Hood R, Kayalackakom T, et al. Transforming medical education: assessing the integration of ChatGPT into faculty workflows at a Caribbean medical school. Cureus. 2023 Jul 5;15(7):e41399. doi: 10.7759/cureus.41399. [PMID: 37426402] [PMCID: PMC10328790]
75. Stahl BC, Wright D. Ethics and privacy in AI and big data: implementing responsible research and innovation. IEEE Security & Privacy. 2018;16(3):26-33. doi: 10.1109/MSP.2018.2701164.
76. Hesham A, Dempere J, Akre V, Flores P. Artificial intelligence in education (AIED): implications and challenges. In Proceedings of the HCT International General Education Conference (HCT-IGEC 2023); 2023 Nov 24; Abu Dhabi, UAE: Atlantic Press; 2023: 126-40. doi: 10.2991/978-94-6463-286-6_1.
77. Rahayu S. The impact of artificial intelligence on education: opportunities and challenges. Jurnal Educatio FKIP UNMA. 2023; 9(4), 2132-40.
78. Owoc ML, Sawicka A, Weichbroth P. Artificial intelligence technologies in education: benefits, challenges and strategies of implementation. In: Ligęza A, Potempa T. IFIP International Workshop on Artificial Intelligence for Knowledge Management; 2019 Aug 11; Cham, Switzerland. Springer International Pub; 2019: 37-58. doi: 10.1007/978-3-030-85001-2_4.

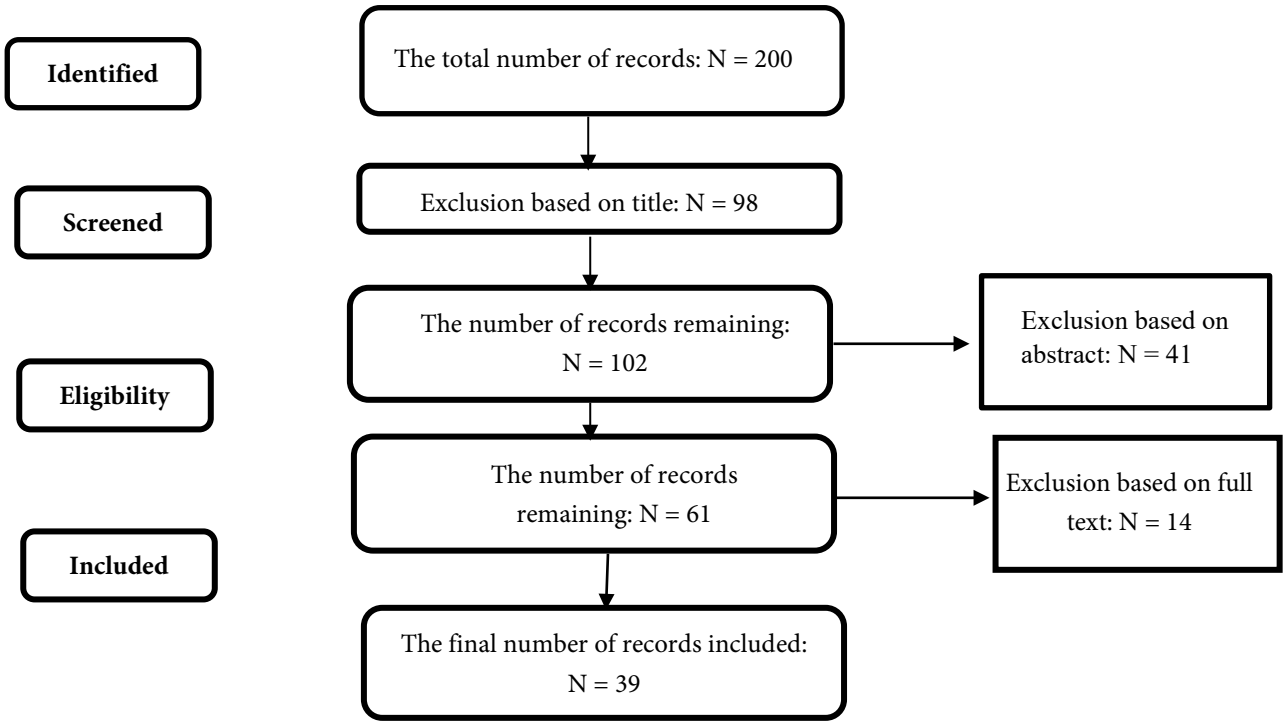

Figure 1. PRISMA flow diagram for information search

Table 1. Demographic characteristics of selected studies

References	Authors	Year	Title
17	Lee	2023	Supporting students' generation of feedback in large-scale online course with artificial intelligence-enabled evaluation
18	Swiecki et al.	2022	Assessment in the age of artificial intelligence
19	Maier & Klotz	2022	Personalized feedback in digital learning environments: Classification framework and literature review
20	Yildirim-Erbasli & Bulut	2023	Conversation-based assessment: A novel approach to boosting test-taking effort in digital formative assessment
21	Smerdon	2024	AI in essay-based assessment: Student adoption, usage, and performance
22	Martínez-Comesanã et al.	2023	Impact of artificial intelligence on assessment methods in primary and secondary education: Systematic literature review
23	Memarian, & Doleck	2024	A review of assessment for learning with artificial intelligence
24	Tonbuloğlu	2023	An evaluation of the use of artificial intelligence applications in online education
25	González-Calatayud et al.	2021	Artificial intelligence for student assessment: A systematic review
26	Casey	2024	ChatGPT in public policy teaching and assessment: An examination of opportunities and challenges
27	Lu et al.	2024	Can ChatGPT effectively complement teacher assessment of undergraduate students' academic writing?
28	Williams	2023	AI, analytics and a new assessment model for universities
29	Salinas-Navarro et al.	2024	Using generative artificial intelligence tools to explain and enhance experiential learning for authentic assessment
30	Lye & Lim	2024	Generative artificial intelligence in tertiary education: Assessment redesign principles and considerations
31	Fahmy	2024	Student perception on AI-driven assessment: Motivation, engagement and feedback capabilities
32	Koh & Doroudi	2023	Learning, teaching, and assessment with generative artificial intelligence: Towards a plateau of productivity
33	Hooda et al.	2022	Artificial intelligence for assessment and feedback to enhance student success in higher education
34	Zirar	2023	Exploring the impact of language models, such as ChatGPT, on student learning and assessment
35	Mao et al.	2024	Generative artificial intelligence in education and its implications for assessment
36	Kooli & Yusuf	2024	Transforming educational assessment: Insights into the use of ChatGPT and large language models in grading.
37	Chaudhry et al.	2023	Time to revisit existing student's performance evaluation approach in higher education sector in a new era of ChatGPT-a case study
38	Ouyang et al.	2023	A systematic review of AI-driven educational assessment in STEM education
39	Xia et al.	2024	A scoping review on how generative artificial intelligence transforms assessment in higher education
40	A. Fuller et al.	2024	Exploring the use of ChatGPT to analyze student course evaluation comments

Table 2. Analytical comparison of selected studies in the main research themes

References	Feedback Applications	Online Exam Applications	Instrument Design Applications	Assessment Process Applications	Student Learning Management Applications	Faculty Workload Management Applications
17	*			*	*	*
18		*	*	*	*	*
19	*			*	*	*
20	*	*		*	*	*
21		*				
22				*		*

23	*	*		*	*	*
24	*	*		*		*
25				*		
26				*		*
27	*					
28	*		*	*	*	*
29	*	*		*	*	*
30				*		*
31				*	*	
32			*	*	*	
33	*		*	*	*	*
34	*					*
35				*		*
36	*					*
37					*	*
38					*	*
39	*			*		*
40				*		

Table 3. Research findings

Main Theme	Sub-theme	Key Concepts
Feedback Applications	Interaction and feedback quality	Constructive and critical feedback; Encouraging and motivating feedback; Improving the quality of feedback; Reducing errors and bias in feedback; Making feedback understandable for students
	Timing and sustainability of feedback	Timely and prompt feedback; Real-time feedback; Feedback timing tailored to each student; Developing sustainable and cyclical feedback mechanisms
	Personalization and flexibility in feedback	Adaptive feedback; Focusing on individual learner goals when providing feedback; Customizing feedback generation rules; Flexibility in providing feedback
	Technology and innovation in feedback	Machine and intelligent feedback; High computational power and analytical framework in feedback delivery; Optimizing learning through feedback; Providing feedback anytime and anywhere
Online Exam Applications	Improving the design and execution process of exams	Improving the quality of exam questions; Multimedia questions; Randomizing exam questions; Fine-tuning the difficulty level of questions; Designing mixed-type exams; Simulating exam questions
	Personalization and optimization of the exam experience	Computerized adaptive testing; Personalizing exam questions; Overcoming student exam anxiety; Assisting in conducting exams in digital environments
Instrument Design Applications	Design and innovation in assessment instrument	Designing creative assessment instruments for students; Assisting in designing standardized instruments; Designing advanced instruments for plagiarism detection; Diversifying grading criteria in instruments
	Improving the accuracy and efficiency of assessment instrument	Enhancing the reliability of measurement instruments; Adjusting scoring weight methods; More diverse and accurate scaling in instruments; Increasing the parameters of instruments; Developing assessment rubrics
Applications in the Assessment Process	Innovation and development of assessment systems	Developing peer assessment mechanisms; Web-based interactive assessment system; Development of electronic assessment platforms; Digital assessment; Creating learner performance dashboards; Integration of online assessment; Innovation in assessment; Development of covert assessment techniques; Assessment management
	Improving assessment processes and standards	Improving current assessment processes; Developing assessment standards; Improving the quality of assessment; Reducing human error in assessment; Reducing human bias in assessment; Greater transparency in the assessment process; Enhanced accountability; Ethics in assessment

	Personalized and learning-aligned assessment	Personalizing assessment; Assessment aligned with learning objectives; Assessment based on previous performances; Objective assessment of outcomes; Collecting multifaceted data in assessment; Collecting behavioral data in assessment; Real-time learning analysis; Analyzing learning behaviors; More accurate prediction of future student grades; Predicting the likelihood of student dropout
	Dynamic assessment strategies and approaches	Diversifying assessment approaches; Game-based assessment; Evidence-based assessment; Developing formative assessment; Group assessment; Stage-based assessments; Developing assessment sequence throughout the semester; Assessment for current and future needs
	Analysis and data-driven assessment	Achieving assessment goals; Learning analysis; Diagnostic analysis of performance causes; Identifying key learning trends; Identifying patterns in behaviors, preferences, and learning achievements of students; More conscious assessment; Assessment for learning; Cognitive analysis-based assessment
Student Learning Management Applications	Supporting personalized and self-regulated learning	Assisting with self-assessment; Helping with self-regulated learning; Developing future learning pathways for students; Helping students identify strengths and weaknesses; Providing recommendations for learners' next steps; Increasing independence in student learning; Enhancing self-directed learning capacity; Helping students choose the most optimal learning path; Assisting students in identifying knowledge gaps; Helping students correct learning behaviors; Helping students understand their own learning
	Developing sustainable learning skills and capabilities	Improving writing skills in exams; Developing students' thinking about their own learning methods; Helping to develop metacognitive skills; Developing metacognitive capabilities; Sustainable and lifelong learning; Problem-based learning; Helping students connect new and prior knowledge; Supporting students in self-development
	Enhancing the quality of learning experience and motivation	Helping improve the quality of class activities; Providing new opportunities to increase student participation; Enhancing learning motivation; Improving satisfaction with education; Helping students better understand learning objectives; Meeting the diverse needs of students; Improving quality learning experiences; Assisting in creating new learning opportunities; Providing students with sufficient opportunity for private learning; Providing individual support to students in identifying areas for improvement and strengthening learning; Helping students organize their activities based on feedback
Faculty Workload Management Applications	Improving efficiency and reducing faculty workload	Eliminating repetitive tasks for faculty members; Reducing the workload of faculty members; Saving time; Facilitating assessment tasks; Grading student assignments; Helping with classroom management; Providing new methods for monitoring learners; Enabling timely and appropriate interventions; Effectiveness in assessment with large classroom scales
	Improving learning and teaching processes	Helping design customized digital tasks for students; Assisting in systematic monitoring of student performance; Designing guidelines for implementing educational corrections; Helping align with teaching strategies; Helping improve the effectiveness of teaching strategies; Designing learning activities based on needs; Designing tasks based on abilities and performance levels; Assisting in adjusting teaching strategies; Designing learning activities based on students' characteristics and abilities; Developing skills and the ability to transfer learning to new situations; Helping review learning objectives; Helping improve educational processes
	Data analysis and supporting student learning	Better understanding of learner behavior in exams; More accurate estimation of students' abilities; Supporting learning-based simulation assessment; Creating performance mapping for students; Helping deliver assignments and learning tasks according to each student's learning level; Identifying areas where students need improvement; Assisting in identifying learning gaps in students; Helping analyze complex data; Assisting in big data analysis; Enabling daily monitoring of student performance; Providing reliable and valid inferences about what students know and can do; Early detection of learning problems; Helping assess student learning outcomes in relation to learning objectives; Determining student competency levels based on assessment results; Helping identify students who need additional support and assistance more quickly

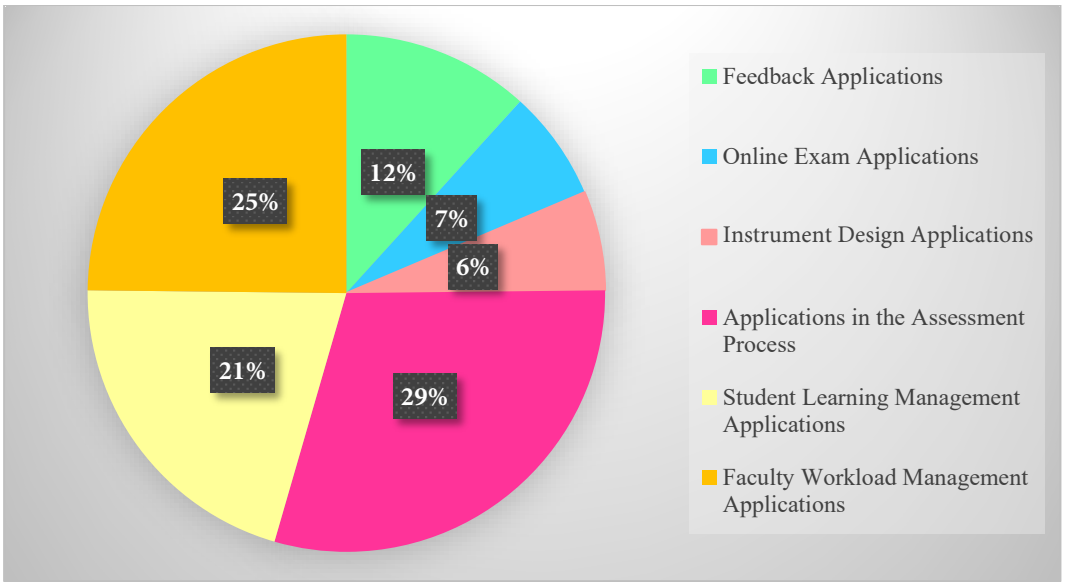

Figure 2. Main themes by frequency

Table 4. Comparative and analytical summary of traditional and AI-based assessment methods for students

Criteria	Traditional Assessment Methods	AI-Based Assessment Methods
Feedback Applications	Interaction and Feedback Quality: Feedback is often subjective, delayed, and less personalized. Timing: Feedback is given after a delay, typically after grading assignments or exams. Personalization: Feedback is generalized and does not cater to individual learning styles. Technology: Limited technological support for feedback delivery.	Quality: AI can offer constructive, real-time, and personalized feedback tailored to individual student needs, reducing errors and bias. Timing: AI provides real-time feedback, immediately addressing performance and offering ongoing support. Personalization: AI customizes feedback based on the learner's performance and goals, creating a more adaptive learning environment. Innovation: AI enables feedback anytime and anywhere, integrating machine learning and high computational power for more accurate insights.
Online Exam Applications	Design and Execution: Exams are often fixed in format and are not easily adaptable Customization: Exams are standardized, offering little flexibility for individual student needs. Anxiety: Traditional exams may increase student anxiety.	Design: AI allows multimedia, randomized questions, and adaptive testing that changes based on the student's ability level. Personalization: AI personalizes exam questions based on prior student performance and adapts difficulty levels. Optimization: AI can help reduce exam-related stress by providing customized test difficulty and predictive tools.
Instrument Design Applications	Design: Assessment tools are manual and rigid, with fixed grading rubrics and criteria. Efficiency: Instruments are typically slow and require manual intervention.	Design & Innovation: AI allows the creation of dynamic and advanced tools for plagiarism detection, diverse grading, and customized rubrics. Accuracy and Efficiency: AI enhances accuracy by refining scoring methods, increasing diversity in assessment, and improving reliability.
Applications in the Assessment Process	Current Systems: Standardized assessment methods with limited interactivity and personalization. Bias and Error: Human bias and error are inherent in manual assessments.	Innovation: AI enables dynamic and web-based interactive systems, real-time performance tracking, and digital assessment platforms. Bias Reduction: AI reduces human error, providing transparent, reliable, and accurate assessments.

Student Learning Management Applications	Traditional Support: Faculty manually supports student learning, with limited monitoring. Learning Pathways: Limited tools for guiding student learning outside of direct faculty interaction.	Self-Regulated Learning: AI assists students with self-assessment, helps track strengths and weaknesses, and provides recommendations for improvement. Learning Pathways: AI offers customized learning paths based on student performance and helps develop lifelong learning skills.
Faculty Workload Management Applications	Workload: Faculty spends significant time on grading, managing assignments, and overseeing learning. Monitoring: Limited ability for monitoring large numbers of students effectively.	Efficiency: AI automates grading, streamlines task management, and supports timely interventions, reducing faculty workload. Data-Driven Decisions: AI helps faculty monitor and analyze student behavior in real-time, improving teaching effectiveness and student performance.

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Letter to editor

Enhancing Comprehension Among Medical Students by Implementing "Teach-Back" in Medical Education

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Keywords: Teach-Back; Student Engagement; Active Learning; Medical Education

Dear Editor,

The use of effective teaching-learning methodologies plays a defining role in the delivery of medical education and is crucial to ensure the attainment of competencies and learning objectives (1). Considering the rapid pace with which the health sector is changing, there is an immense need for efforts to not only impart medical knowledge but also encourage critical thinking, clinical reasoning, and foster the delivery of empathetic and compassionate healthcare services (1). Further, as we strive towards cultivating a culture of self-directed and lifelong learning among medical students, there is a definitive need to employ effective teaching-learning methodologies (1).

In medical education, the "teach-back" technique has been employed to assess comprehension and retention of information among medical students (2). In simple words, it means that after students are taught a specific topic, they summarize and present the subject taught in their own words to the teacher or their peers (2, 3). This method helps teachers to measure the depth of understanding and extent of retention of concepts or procedures by medical students, which is exactly opposite to the conventional teaching methods, where students are passive learners (3, 4). The use of teach-back as an assessment method aids in measuring understanding and comprehension, as students have to process and interpret the information (3). This plays a significant role in the development of critical thinking skills, which are crucial for successful clinical practice (2, 3).

Acknowledging the scope and merits of the teach-back method in facilitating the acquisition of knowledge and skills, there arises the need to take targeted steps to systematically incorporate the same into the existing curriculum (2-4). This implementation can be done using multiple methods, like interactive didactic lectures, small group discussions, case-based discussions, journal club sessions, role-plays, standardized patient encounters, peer teaching, and objective structured clinical examinations (2-6). The best part of teach-back method is that it can also be used as an assessment tool by either asking students to provide a written or a verbal summary of a specific topic, concept, or procedure, and this will provide insights about understanding and retention of the gained knowledge or skills (3-5). Once students provide a summary, teachers can assess the ability of students to synthesize information and the effectiveness of communication (4, 5). As students are given the task of teaching their peers, they can provide feedback on the clarity and quality of the explanation provided (2, 4). If the institution can design well-defined rubrics, the utility of the teach-back method as an assessment tool can be significantly enhanced, as the process becomes objective and structured.

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In our vision to successfully implement teach-back methods in medical curriculum, many challenges have been identified, and they must be systematically addressed (Table 1) (2-6). This begins with resistance to change from educators and administrators, and if they are not on our side, we cannot successfully implement it. Thus, there is an immense need to convince administrators about the utility and teachers about how it can be successfully implemented within the existing curriculum (3, 6). Teachers are reluctant to accept this as they are used to traditional teaching methods, or they are concerned about how they will employ these methods in their class and still not extend their class duration. Administrators can be reluctant as they are worried about the utility of the same (6).

Table 1. Identified challenges and potential solutions

Identified challenges	Potential solutions
Untrained faculty members	Train teachers about the scope, need, and do's and don'ts of "teach-back" method Incorporate the principles of active learning in faculty development programs Extend continuous support and resources for teachers and also about the best practices An open platform of communication can be created wherein teachers can ask raise their queries and get prompt support
Resistance to change	Create an open platform for teachers and students to engage in transparent communication about teach-back Foster a shared vision and sense of ownership among faculty, administrators, and students Train teachers about the scope, need, and do's and don'ts of "teach-back" method
Resistance to active learning	Train faculty members regarding the merits and approaches to implement active learning Share evidence of merits of employment of "teach-back" method in promoting student engagement and improvement of learning outcomes Encourage teachers to adopt innovative teaching-learning methodologies, which can facilitate active learning among medical students
Lack of student engagement or cultural differences	Promote creation of an inclusive learning environment wherein all students actively participate in discussion Teachers can employ active learning methods to deal with students with different learning styles Provide opportunities for peer collaboration and interaction to enhance student engagement and motivation Promote cultural sensitivity and awareness among teachers and students
Time constraints	Teach-back activities should be integrated in the existing sessions, as a part of the routine sessions Identify key concepts or topics, wherein teach-back activities can be employed, with specific focus on active engagement of students Explore the possibility of technology (in the form of online platforms and mobile applications) to enable asynchronous participation
Large class size	Teachers can be trained in "teach-back" methodologies to enhance their competence levels in carrying out such sessions with larger group of medical students Large group of students can be divided into smaller groups to enable feasible interaction and active participation Educators can employ polling or audience response systems (clickers) to encourage participation from all learners during large-group sessions
Subjective assessment and grading	Develop clear and transparent assessment criteria and rubrics for evaluating "teach-back" activities Provide timely and constructive feedback to students, highlighting strengths and areas for improvement Incorporate peer / self-assessment into "teach-back" activities, encouraging students to reflect on their own learning process, and thereby ensure continuous improvement
Technological limitations	Explore simplified alternatives (like flipcharts, whiteboards, etc.) to summarize information Use existing technical resources to facilitate "teach-back" activities

Some of the teachers might be worried about the large class size, in the sense of how they can ensure the active engagement of all students in a large class (5, 6). Finally, there is a concern of subjectivity in assessing teach-back methods as an assessment tool. The Medical Education Unit and the Curriculum Committee of the institution play a defining role in the smooth incorporation and implementation of the teach-back methods in the regular teaching sessions. The use of technology and online platforms can significantly minimize operational constraints. Further, there is a need to adopt a multipronged approach to overcome the

existing challenges and enhance the utility of teach-back methods in facilitating learning and improving the attainment of learning competencies (4-6).

In conclusion, medical education continues to advance and evolve, there is an immense need to employ interactive teaching-learning methods for the benefit of students. The teach-back method is an effective tool to assess comprehension, promote active learning, develop critical thinking, and facilitate meaningful engagement with the learning resources. Thus, it is the need of the hour to introduce such methods in the medical curriculum for the successful attainment of learning outcomes.

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References

1. Challa KT, Sayed A, Acharya Y. Modern techniques of teaching and learning in medical education: a descriptive literature review. MedEdPublish (2016). 2021 Jan 21:10:18. doi: 10.15694/mep.2021.000018.1. [PMID: 38486533] [PMCID: PMC10939590]
2. Shersher V, Haines TP, Sturgiss L, Weller C, Williams C. Definitions and use of the teach-back method in healthcare consultations with patients: A systematic review and thematic synthesis. Patient Educ Couns. 2021 Jan;104(1):118-129. doi: 10.1016/j.pec.2020.07.026. [PMID: 32798080]
3. Yen PH, Leasure AR. Use and effectiveness of the teach-back method in patient education and health outcomes. Fed Pract. 2019 Jun;36(6):284-289. [PMID: 31258322] [PMCID: PMC6590951]
4. Sleiman AA, Gravina NE, Portillo D. An evaluation of the teach-back method for training new skills. J Appl Behav Anal. 2023 Jan;56(1):117-130. doi: 10.1002/jaba.966. [PMID: 36454877]
5. Samuels-Kalow M, Hardy E, Rhodes K, Mollen C. "Like a dialogue": Teach-back in the emergency department. Patient Educ Couns. 2016 Apr;99(4):549-554. doi: 10.1016/j.pec.2015.10.030. [PMID: 26597382] [PMCID: PMC4808368]
6. Talevski J, Wong Shee A, Rasmussen B, Kemp G, Beauchamp A. Teach-back: A systematic review of implementation and impacts. PLoS One. 2020 Apr 14;15(4):e0231350. doi: 10.1371/journal.pone.0231350. [PMID: 32287296] [PMCID: PMC7156054]

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Brief Report

Investigating the Knowledge and Attitude Gap Regarding Climate Change Between Medical and Non-Medical Students: The Necessity of a Comprehensive Curriculum

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Abstract

Background: Climate change is among the most critical global issues, threatening economies, ecosystems, and human health. It has increased the frequency of heat waves, floods, and droughts, impacting food security, agriculture, and disease patterns. Despite its importance, many medical schools have not sufficiently incorporated climate change into their curricula, leaving future physicians underprepared to address its health impacts.

Objectives: This study assesses medical and non-medical students' awareness, attitudes, and behaviours toward climate change. It emphasizes integrating climate change topics into medical education to prepare students to address health-related challenges and become responsible healthcare professionals.

Methods: In this cross-sectional analytical study, 375 medical and non-medical university students from Kerman province (2023) were enrolled. Data were collected using a validated five-part questionnaire based on Alina Kote's tool, assessing attitudes, awareness, personal concerns, reinforcing, and adaptive behaviours. Convenience sampling was utilized, and ANOVA was conducted to compare the mean scores between the groups. Reliability was confirmed (Cronbach's $\alpha = 0.89$).

Results: The participants included 41.3% males and 58.7% females. Medical students had significantly higher scores in attitudes ($p < 0.001$), personal concerns ($p < 0.001$), and adaptive behaviours ($p = 0.011$), but lower scores in awareness ($p < 0.001$) and reinforcing behaviours ($p = 0.014$) compared to non-medical students. Gender showed no significant influence on the outcomes. Graduate students scored higher in reinforcing and adaptive behaviours than undergraduates ($p = 0.014$ and $p = 0.011$, respectively).

Conclusion: The study found that gender does not affect students' attitudes, knowledge, or adaptive behaviors toward climate change. The results highlight the importance of integrating climate change topics into curricula for all disciplines. Educational interventions tailored to each university are recommended to increase students' awareness and ability to engage in climate adaptation and mitigation. Additionally, students can play a key role in raising public awareness and influencing policy changes at the community level.

Keywords: Climate Change; Global Warming; Awareness; Students

Background

Climate change is one of the most urgent global issues, threatening both the planet and the global economy. It has already caused a temperature increase of approximately 1°C and could rise by up to 6.4 °C (1). The consequences include more frequent heat waves,

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floods, and droughts, which impact human health through diseases, injuries, and mental health problems (1-3). Moreover, climate change disrupts food security and agricultural production (4). These effects emphasize the need for preventive measures to mitigate and adapt to climate-related challenges.

Education plays a crucial role in addressing climate change. As UNESCO (2003) states, education must evolve to protect the planet's future (5). Addressing climate change requires a solid foundation of scientific knowledge and a belief in its reality and impacts (6). Schools and universities can promote community participation by raising awareness and helping students engage in democratic decision-making (7). However, many medical schools have yet to integrate climate change into their curricula comprehensively, leaving healthcare professionals unprepared to address its health-related challenges (8, 9). For instance, incorporating climate change into medical and public health curricula at the University of Cape Town and Stanford University has enhanced students' knowledge and attitudes towards this issue (8, 10, 11). By equipping future healthcare professionals with the necessary skills, they can become leaders in promoting public health and sustainability (7).

Tackling climate change requires immediate and collective action. By providing students with accurate information and a sense of responsibility, educators and policymakers can foster a more environmentally conscious society, laying the foundation for a sustainable future (12, 13). Students can also play a crucial role in devising innovative strategies to reduce and adapt to climate change by expanding their knowledge, shaping public opinion, and participating in research (14). Universities are pivotal in raising awareness by integrating climate-related topics into curricula and extracurricular activities, helping develop responsible specialists for the future (15-17).

Environmental literacy is essential for encouraging behaviors that mitigate climate change. Innovative educational initiatives can advance cleaner air, nature restoration, and economic growth, transcending political and religious boundaries (18). Awareness of the risks associated with climate change influences behavioral strategies to reduce its impacts (19). Additionally, individuals with more media exposure are more likely to engage in climate-related discussions, underscoring the importance of access to information (20). Promoting health behaviors that reduce vulnerability to climate change is essential, as traditional responses are often inadequate (21).

A study at the University of Heidelberg revealed that while 72.4% of medical students believe physicians should address climate change, only 4.7% felt adequately prepared by their education. This highlights the urgent need to integrate climate-related topics into medical training (22, 23). Higher education institutions must also engage in regional solutions, develop new curricula, and study cultural perceptions of climate change to improve communication and education (24).

Several studies indicate that positive attitudes toward climate change are linked to greater awareness, although these attitudes do not always translate into practical behavior (25). Building capacity through educational programs is crucial, as many students lack the skills to confront climate challenges (26). Greater awareness is associated with more positive environmental attitudes and behaviors (27), and participatory educational activities can foster responsibility in solving environmental problems (28, 29). Media, workshops, and personal experiences are essential for shaping students' views on climate change (30). Furthermore, students' awareness increases with age and education, leading to greater participation in climate reduction efforts (31).

Research has identified a significant gap between the knowledge of medical and non-medical students regarding climate change, underscoring the need for further studies to tailor educational programs across different fields (32). Moreover, many medical students understand the importance of climate change but lack the practical skills to address it, highlighting the need for skill-based education (33). A more systematic integration of climate-related topics in curricula is required to prepare future professionals (34). Understanding non-medical students' knowledge and attitudes toward climate change is equally important for developing comprehensive educational programs (35). Insights from such research can help policymakers enhance curricula and shape effective health policies to address climate change's complex challenges (36).

Objectives

This study assesses medical and non-medical students' awareness, attitudes, and behaviors toward climate change. It emphasizes integrating climate change topics into medical education to prepare students to address health-related challenges and become responsible healthcare professionals.

Methods

The current study is a cross-sectional study to assess the knowledge, attitude, and impact of climate change among medical students in 2023 by descriptive indices and analysis of variance (ANOVA) compared to other universities. The study population consisted of university students in Kerman province in medical and non-medical colleges. Cochran's formula was used to calculate the sample size, where the Z-value was set at 1.96 based on a 5% margin of error and the desired level of sampling error (d) to be 0.05. Since p, which represents the estimated proportion of the population possessing the characteristic under study, is unknown a priori, we assumed it to be 0.5 to maximize variance and determine the largest required sample size. Using a population of 110,683 students in Kerman province, the sample was defined as 383 people.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left[\frac{z^2 pq}{d^2} - 1\right]}$$

A convenience sampling method was employed, and all students were invited to participate; 376 responded by completing the evaluation questionnaire. The inclusion criterion was current enrolment at universities in Kerman province, while the exclusion criterion was a lack of willingness to participate.

The data collection instrument was a five-part questionnaire adapted from Alina Cote's study. Following the translation and localization of specific questions, the Content Validity Index (CVI) and Content Validity Ratio (CVR) were used to assess the tool's content validity. Ten disaster health experts evaluated the questionnaire, and their feedback was incorporated into the final version. The CVI score was 0.85, indicating strong content validity, while the CVR score of 0.70 indicated the essential nature of the questions according to the experts. The questionnaire's reliability was confirmed through an expert panel using Cronbach's alpha ($\alpha = 0.89$).

The questionnaire included a demographic section with five questions on attitudes, three questions on individual concerns, four questions on awareness, four questions on reinforcing behaviors, and eight questions assessing climate change adaptation behaviors. The tool used a 6-point Likert scale ranging from very poor to excellent. The total score of the questionnaire ranged from 24 to 144.

The questionnaire was designed on the Porsline platform and shared through various social media platforms (Telegram, Eitaa, WhatsApp, Baleh) via student groups managed by the universities' cultural units. Data were collected online. A total of 376 questionnaires were received. Data analysis was conducted using SPSS version 23.

This study was registered with ethical approval number IR.KMU.REC.1403.133 at Kerman University of Medical Sciences.

Results

The demographic data of the 375 participants, consisting of associate, bachelor's, master's, and doctoral students from universities affiliated with the Ministry of Health and other institutions, revealed that 155 (41.2%) were men, and 220 (58.5%) were women. Additionally, 276 participants (73.4%) were students at medical universities. Most participants, 272 (72.3%), were undergraduate and graduate students (Table 1).

Table 1. Demographic status

Variable		Frequency	Percent
Sex	Men	155	41.2
	Women	220	58.5
Education level	PhD-Associate	103	27.5
	Master	73	19.5
	Bachelor	199	53
University	Medical Sciences	276	73.4
	Sciences	99	26.6

In the analysis of variance (ANOVA), no significant differences were observed in students' responses to questions about climate change across five domains based on gender. However, medical students scored higher in attitude, personal concern, and adaptive behaviors, while scoring lower in awareness and reinforcing behaviors compared to non-medical universities (Table 2).

Table 2. Comparison of Mean Scores between Medical and Non-Medical Students

University	Attitude	Concern Persona	Awareness	Reinforcing Behaviors	Adaptive Behaviors
	Mean (SD)				
Medical Sciences	4.56 (0.72)	4.26 (0.95)	3.77 (0.72)	3.14 (1.07)	4.60 (0.79)
Other Universities	4.39 (0.77)	3.54 (0.94)	4.22 (0.79)	3.36 (1.09)	4.58 (1.05)
Total	4.51 (0.74)	4.07 (0.99)	3.88 (0.76)	3.20 (1.08)	4.60 (0.87)

SD: Standard deviation

The differences in awareness and personal concern were statistically significant (P < 0.001), whereas other domains showed no significant variation (Table 3). Medical students obtained significantly better scores than the Ministry of Science students on questions about Attitude, Concern Persona, and Adaptive Behaviors. However, they were weaker in Awareness and Reinforcing Behaviors. Differences in responses are statistically significant for the Concern Persona and Awareness domains (P < 0.001) (Tables 3, 4).

Table 3. Analysis of Variance of Different Domains by University Type

Variable	F	P-value
Attitude	3.843	0.051
Personal Concern	40.933	0.000
Awareness	26.981	0.000
Reinforcing Behaviors	2.974	0.085
Adaptive Behaviors	0.057	0.811

Medical students obtained significantly better scores than the Ministry of Science students on questions about Attitude, Concern Persona, and Adaptive Behaviours. However, they were weaker in Awareness and Reinforcing Behaviours (Table 2). Differences in responses are statistically significant for the Concern Persona and Awareness domains (P < 0.001) (Table 3).

Masters and PhD students scored higher across all domains, with statistically significant differences in reinforcing and climate change adaptation behaviours. (Reinforcing Behaviours: P = 0.014, Adaptive Behaviours: P = 0.011) (Table 4).

Table 4. Analysis of variance of Different Domains by Educational Level

Variable	F	P-value
Attitude	2.430	0.120
Personal Concern	0.044	0.833
Awareness	0.034	0.854
Reinforcing Behaviors	6.155	0.014
Adaptive Behaviors	6.475	0.011

Discussion

This study is the first to collect data on students from medical and non-medical universities regarding attitudes, personal concerns, awareness, reinforcing behaviours, and adaptive behaviours related to climate change.

The findings indicate that gender does not affect students' attitudes, knowledge, and adaptive behavior regarding climate change. This shows the role of higher education and postgraduate education in this group's knowledge, attitudes, and behaviour.

Graduate students scored higher across all examined areas than undergraduate and diploma students. Medical Sciences University students scored higher in areas related to attitudes, personal concerns, and adaptive behaviors toward climate change. Still, they scored lower in awareness and enhancing behaviors than students from other universities. This difference was significant in areas of awareness and personal concerns. (P < 0.001)

The study's findings by Zolfaghari et al. indicate that students' knowledge level about global warming and climate change is average. Still, there is no difference in students' level of awareness based on gender (29), which is consistent with the results of this study. However, there was no difference between students' awareness level and the faculty in which they were studying.

In the present study, medical university students in Kerman expressed higher levels of concern than students in other universities, but their level of awareness was lower.

The presence of various disciplines and specializations in climatology, geography, and geology at universities in Kerman under the supervision of the Ministry of Science has led to increased awareness among students regarding climate change. This highlights that climate change-related courses and their impact on health are less emphasized in the curricula of medical universities, except for fields such as health in disasters and emergencies. As a result, there is lower awareness and, consequently, higher levels of concern among medical students. In the study by Zolfaghari et al. (29), there was a statistically significant difference between males and females in the level of awareness and attitude, which was not consistent with the results of the present study. Therefore, by emphasizing the influence sphere of students and raising their awareness about concrete actions related to daily life, especially in individual activities, their self-efficacy can be strengthened to perform climate-adaptive behaviors. Thus, in this study, we examined the attitudes, knowledge, personal concerns, and adaptive behaviors of students in Kerman province toward climate change. The results of this research indicate that there is no significant difference between men and women in terms of awareness regarding the variables measured, which aligns with the studies by Zolfaghari et al. (29) and Yasen

et al. (31) but contradicts those by Lill Filho et al. (35) and Harrod et al. (37).

Regarding students' attitudes toward climate change, our findings are consistent with the studies by Ramezani and colleagues (38), Emma C. Ryan et al. (39), Asmaa Ebrahim et al. (40), Harrod et al. (37). The results show an adequate level of knowledge and awareness among students about climate change, which agrees with the research by Lill Filho et al. (35), Yasen et al. (31), Harrod et al. (37) and Kumar et al. (32).

This study indicates that graduate students scored higher on all questions across all domains, consistent with the investigations by Zolfaghari et al. (29) and Filho et al. (35). Given that reinforcing behaviors had higher scores among graduate students, it can be concluded that proper education for this group can effectively influence society in changing behaviors related to climate change. Additionally, medical science students scored higher on attitude, personal concern, and adaptive behavior domains associated with climate change but lower on knowledge and reinforcing behavior questions than the Ministry of Science students. Panahi et al.'s study showed that individuals express more concern when information regarding harm is presented. This difference in response to questions about knowledge and personal concerns was significant and aligned with positive student attitudes toward climate change in the present study (34).

Limitations: This study was only conducted among students from southeastern countries. A convenience sampling method was used, which may limit the generalizability of the study's results. This study did not examine other factors that might influence students' attitudes, knowledge, and behaviors regarding climate change. Given these limitations, further research is proposed using more diverse sampling methods and in various geographical areas to obtain more generalizable results.

Conclusion

Numerous studies have emphasized the significant carbon emissions from high resource consumption, including energy and waste generation, by laboratories and healthcare sectors, especially medical universities. Therefore, it is imperative to revise medical curricula to integrate climate change topics, empowering medical students to play an active role in safeguarding public health and the environment. Moreover, given the nature of their mission in public health and the availability of suitable infrastructure for enhancing community preparedness regarding the effects of climate change, increasing the awareness of graduates from these universities should be a goal for planners and policymakers in the Ministry of Health. On the other hand, the consequences of low awareness levels among students and the general public will affect the healthcare system. Given the findings of this study, it is suggested that medical universities and other institutions develop educational programs and interventions appropriate for enhancing awareness and supportive behaviors regarding climate change among students. This includes fostering attitudes, personal concerns, and adaptive behaviors towards climate change. Additionally, specialized training courses on climate change and coping strategies should be considered for postgraduate students. A comprehensive educational program and curriculum planning across all disciplines and academic levels, or a general course incorporating climate change topics into similar subjects, is also recommended. It is important to consider gender and educational differences in designing educational programs related to climate change. Organizing workshops and seminars on climate change, including practical information relevant to life, can enhance students' knowledge and self-efficacy in performing adaptive actions and mitigating the effects of climate change. Furthermore, interdisciplinary collaborations between medical students and those from other fields for knowledge and experience exchange on climate change should be encouraged. Increasing awareness and adaptive behavior towards climate change through creating an environment in universities that encourages green culture and environmental responsibility is crucial. Encouraging students to conduct research projects and collaborate with scientific institutions on climate changes and coping strategies, utilizing students as a significant societal group for public education and policy change at the community level, conducting further research in other universities to understand the level of knowledge, attitudes, and individual concerns of students about climate issues, and organizing continuous international conferences on climate changes at university level are among the other suggestions of this study.

One strength of this study is its performance on a relatively large sample of students, providing access to extensive and reliable data. Moreover, a reputable measurement tool has been used for data collection, ensuring accuracy and high validity. The results of this study can be beneficial for educational planning and

interventions in the field of climate change as they provide valuable information about students' attitudes, knowledge, and behaviors related to this issue.

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References

1. Hartley A, Tandon A. The impacts of climate change. Frontiers for Young Minds. 2022; 716479: 10. doi: 10.3389/frym.2022.716479.
2. Dehghani MR, Noori Hekmat S, Beigzadeh A. Teaching in Clinical Rounds When Driven by the COVID-19 Pandemic. Strides Dev Med Educ. 2020; 17(Supplement): 1-2. doi: 10.22062/sdme.2020.91027.
3. Bunz M, Mücke H-G. Climate change–Physical and mental consequences. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz. 2017 Jun;60(6):632-9. doi: 10.1007/s00103-017-2548-3. [PMID: 28447137]
4. Anderson R, Bayer P, Edwards D. Climate change and the need for agricultural adaptation. Curr Opin Plant Biol. 2020 Aug:56:197-202. doi: 10.1016/j.pbi.2019.12.006. [PMID: 32057694]
5. Kurup PM, Levinson R, Li X. Informed-decision regarding global warming and climate change among high school students in the United Kingdom. Can. J Sci Math Techn Educ. 2021;21:166-85. doi: 10.1007/s42330-020-00123-5.
6. Thomm E, Bromme R. "It should at least seem scientific!" Textual features of "scientificness" and their impact on lay assessments of online information. Science Education. 2012;96(2):187-211. doi: 10.1002/sce.20480.
7. Fensham PJ. The future curriculum for school science: What can be learned from the past? Research in Science Education. 2022;52(Suppl 1):81-102. doi:10.1007/s11165-022-10090-6.
8. Gomez J, Goshua A, Pokrajac N, Erny B, Auerbach P, Nadeau K, et al. Teaching medical students about the impacts of climate change on human health. The Journal of Climate Change and Health. 2021;3:100020. doi: 10.1016/j.joclim.2021.100020.
9. Parvaresh-Masoud M, Rahimkhanli M, Torabian H, Motamed-Jahromi M, Dehghani M, Farahmandnia H. Perspectives of Emergency Medical Technicians on the Integration of Medical Science Education in Prehospital Emergency Care in Iran: A Thematic Analysis Study. Strides Dev Med Educ. 2024; 21(1): 99-105. doi: 10.22062/sdme.2024.198827.1268.
10. Dehghani MR, Salajegheh M, Fasihi Harandi M, Bahaadinbeigy K, Bahman Bijari B, Shakiba Z, et al. Design, Implementation, and Evaluation of a Medical Education Fellowship Program for the Faculty Members of Kerman University of Medical Sciences Based on the Kirkpatrick Model. Strides Dev Med Educ. 2018; 15(1): e64668. doi: 10.5812/sdme.64668.
11. Irlam J, Razzak Z, Parker Q, Rother H. Student knowledge and perceptions of climate change and environmental sustainability at the Faculty of Health Sciences, University of Cape Town, South Africa. African Journal of Health Professions Education. 2023;15(1):2-6. doi: 10.7196/AJHPE.2023.v15i1.1659.
12. Esakkimuthu K, Banupriya S. Awareness about Climate Change among Students: A Sustainable Future. ComFin Research. 2023;11(4):1-6. doi:10.34293/commerce.v11i4.6677.
13. Dehghani S, Bahmanpour K, Nouri B, Valiee S. Effect of Blended Education on Nursing Students' Awareness and Attitude Towards Organ Donation: A Solomon Four-Group Study. Strides Dev Med Educ. 2018; 15(1): e79938. doi: 10.5812/sdme.79938.
14. Vujović M, Krstić II. The Challenge of Climate Change For Students of Journalism in the South Of Serbia. Media Studies and Applied Ethics. 2022;3(2):47-62. doi:10.46630/msae.2.2022.04.
15. Trott CD, Lam S, Roncker J, Gray ES, Courtney RH, Even TL. Justice in climate change education: a systematic review. Environmental Education Research. 2023;29(9):1535–72. doi: 10.1080/13504622.2023.2181265.
16. Mazroie S, Dehghani MR, Yamani N, Sabzevari S. Evaluation of Medical University Deputies' and Managers' Perspectives on the Outcomes of Institutional Accreditation of Medical Universities from 2018-2019. Strides Dev Med Educ. 2021; 18(1): 1-7. doi: 10.22062/sdme.2021.195647.1040.
17. Amini M, Dehghani MR, Kojuri J, Safaee Ardekani GR, Sagheb MM, Saber M, et al. The Participants Point of View about the First National Interdisciplinary Summer School regarding Achievement of Educational Objectives Shiraz Iran. Strides Dev Med Educ. 2010; 6(2): 185-8. [In Persian]
18. Kumar P, Sahani J, Rawat N, Debele S, Tiwari A, Emygdio APM, et al. Using empirical science education in schools to improve climate change literacy. Renewable and Sustainable Energy Reviews. 2023;178:113232. doi:10.1016/j.rser.2023.113232.
19. Scannell L, Gifford R. Personally relevant climate change: The role of place attachment and local versus global message framing in engagement. Environment and Behavior. 2013;45(1):60-85. doi:10.1177/0013916511421196.
20. Ballew MT, Leiserowitz A, Roser-Renouf C, Rosenthal SA, Kotcher JE, Marlon JR, et al. Climate change in the American mind: Data, tools, and trends. Environment: Science and Policy for Sustainable Development. 2019;61(3):4-18. doi:10.1080/00139157.2019.1589300.
21. Chevance G, Fresán U, Hekler E, Edmondson D, Lloyd SJ, Ballester J, et al. Thinking health-related behaviors in a climate change context: a narrative review. Ann Behav Med. 2023 Apr 5;57(3):193-204. doi: 10.1093/abm/kaac039. [PMID: 35861123] [PMCID: PMC10074036]
22. Nekoei-Moghadam M, Moradi SM, Khademipour G, Dehghani MR. Determining the Training Requirements of Disaster Medical Assistance Teams (DMATs) in Iran; A Novel Approach. Strides Dev Med Educ. 2024; 21(1): 203-217. doi: 10.22062/sdme.2024.199747.1374.
23. Rybol L, Nieder J, Amelung D, Hachad H, Sauerborn R, Depoux A, et al. Integrating climate change and health topics into the medical curriculum–a quantitative needs assessment of medical students at Heidelberg University in Germany. GMS J Med Educ. 2023 May 15;40(3):Doc36. doi: 10.3205/zma001618. [PMID: 37377571] [PMCID: PMC10291352]
24. Chowdhury MTA, Ahmed KJ, Ahmed MNQ, Haq SMA. How do teachers' perceptions of climate change vary in terms of importance, causes, impacts, and mitigation? A comparative study in Bangladesh. SN Soc Sci. 2021;1(7):174. doi: 10.1007/s43545-021-00194-7. [PMID: 34693329] [PMCID: PMC8294221]
25. Dopelt K, Davidovitch N, Loren O, Gapich G. Does climate change matter to us? Knowledge, attitudes, and environmental behavior. European Journal of Public Health. 2020; 30 (Supplement_5): ckaa166- 079. doi: 10.1093/eurpub/ckaa166.079.
26. Ghanem A. Assessment knowledge, perception, and behaviors towards climate change among university youth in Egypt. Athens J Mediterr Stud. 2022;8:1-16. doi: 10.30958/ajms.9-1-4.
27. Ratinen I, Uusiautti S. Finnish students' knowledge of climate change mitigation and its connection to hope. Sustainability. 2020;12(6):2181. doi: 10.3390/su12062181.
28. Kroufek R, Nepraš K. The impact of educational strategies on primary school students' attitudes towards climate change: A comparison of three European countries. European Journal of Science and Mathematics Education. 2023;11(3):466-74. doi:10.30935/scimath/12945.

29. Zolfaghari H, Somayeh N. Evaluation of environmental knowledge Razi University students With an emphasis on global warming and climate change. Human & Environment. 2023: 20(4): 129-45. [In Persian]
30. Ghanbari S, Jafari M, Nemati Z, Hatami J. Assessment of Information of Environmental and Climate Changes of High School Students in Tabriz City and the Effect of Education on their Knowledge. Human and Environment. 2022; 20(2): 1-18. [In Persian]
31. Yaseen M, Ahmed J, Riaz A. An investigation on the climate change awareness and concerns. Journal of Social Research Development. 2022;3(2):193-211. doi: 10.53664/JSRD/03-02-2022-06-193-211.
32. Kumar B, Asad AI, Chandraaroy B, Banik P. Perception and knowledge on climate change: A case study of university students in Bangladesh. Journal of Atmospheric Science Research. 2019;2(3):17-22. doi: 10.30564/jasr.v2i3.1542.
33. Kuthe A, Keller L, Körfgen A, Stötter H, Oberrauch A, Höferl K-M. How many young generations are there?–A typology of teenagers' climate change awareness in Germany and Austria. The Journal of Environmental Education. 2019;50(3):172-82. doi: 10.1080/00958964.2019.1598927.
34. Panahi M, Dehghan Shabani Z. Investigating the Effect of Framing to Change Attitudes and Behaviors Towards Climate Chang. J Env Sci Tech. 2023; 24(11): 27-39. [In Persian]
35. Leal Filho W, Ayal DY, Wall T, Shiel C, Paco A, Pace P, et al. An assessment of attitudes and perceptions of international university students on climate change. Climate Risk Management. 2023 ;39: 100486. doi:10.1016/j.crm.2023.100486.
36. Berger S, Cologna V, Bauer JM. Mitigating Climate Change Via the Demand Side and Behavioral Insights: Policy Recommendation and Current Challenges. Policy Insights from the Behavioral and Brain Sciences. 2024. 11(2): 164-71. doi:10.1177/23727322241275147.
37. Harrod SE, Rolland V. Factors associated with attitudes and knowledge of first-semester college students toward climate change. BioScience. 2021;71(4):415-25. doi:10.1093/biosci/biaa151.
38. Ramazani M, Sharifzadeh GR, Eslamian SS, Sohrabi R. Human & Environment. 2019;47:103–117. [In Persian]
39. Ryan EC, Dubrow R, Sherman JD. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. BMC Med Educ. 2020 Jun 23;20(1):200. doi: 10.1186/s12909-020-02099-0. [PMID: 32576175] [PMCID: PMC7310528]
40. Ibrahim AA, Mohamed SS, Abd El-Mohsen AM. Knowledge and attitude regarding global warming phenomenon among Assiut University students. Assiut Scientific Nursing Journal. 2018;6(14):1–11. doi:10.21608/asnj.2018.58596.

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Original Article

Investigating the Psychometric Properties of the Persian Version of the Multidimensional Test Anxiety Scale (MTAS)

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Abstract

Background: Physical, mental, and behavioral signs of exam anxiety show themselves throughout test preparation. This research sought to explore the psychometric characteristics of the Persian version of the Multidimensional Test Anxiety Scale (MTAS) among university students given the absence of a tool to assess the many aspects of test anxiety.

Objectives: Given the lack of a reliable and valid Persian-language scale for measuring the dimensions of test anxiety, the present study was conducted with the aim of examining the psychometric properties of the Persian version of the Multidimensional Test Anxiety Scale among university students.

Methods: Convenience sampling was used to choose 232 Jundishapur University of Medical Sciences students for this descriptive, psychometric research in 2022.Participants filled out the Rosenberg Self-Esteem Scale, the Frost Multidimensional Perfectionism Scale-Short Form, and the MTAS. Confirmatory factor analysis was part of the MATS's psychometric analysis, which was assessed using LISREL 8.8 and SPSS version 25.

Results: Confirmatory factor analysis verified the four-factor structure of the MTAS (Worry, Cognitive Interference, Tension, and Physiological Indicators).The MTAS exhibited an internal consistency of 0.93, while the Worry, Cognitive Interference, Tension, and Physiological Indicators subscales exhibited internal consistency of 0.88, 0.81, 0.89, and 0.83, respectively, as determined by Cronbach's alpha coefficient. The MTAS demonstrated strong divergent and convergent validity.

Conclusion: The MTAS has acceptable reliability and validity, as indicated by the results. The results of this investigation have the potential to enhance the cross-cultural literature on the MTAS.

Keywords: Scale; Test Anxiety; Validity; Reliability

Background

Educational and psychological literature have long acknowledged test anxiety as a substantial factor. The negative correlation between test anxiety and both student well-being and test progress and performance (1, 2) is the primary determinant of its association. There is a lack of consensus regarding the components that should be included within the test anxiety construct, despite the fact that there are numerous established and valid psychometric instruments for measuring test anxiety (3, 4). Furthermore, practitioners frequently encounter obsolete instruments that are devoid of suitable norms and thresholds for identifying individuals who require assistance and intervention (5). Test anxiety is a trait that is situation-specific; it is a consistent inclination or disposition to perceive performance appraisal situations (situations in which one's performance is evaluated in some capacity) as menacing and respond with high-level anxiety to the situation (6). High-trait anxious individuals may not necessarily respond to non-performance appraisal situations (such as those involving physical peril, ambiguity, separation, or daily routines) with sustained state anxiety, as trait anxiety is multidimensional (7). The initial conceptualizations of test anxiety were centered on a single dimension (8). The identification of distinct cognitive and emotional-physiological components within test anxiety was a significant

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advancement (9). There is a widespread agreement that test anxiety is a multifaceted concept that includes cognitive and emotional-physiological components (5). In 2020, Putwain et al. created the MTAS, an instrument that is intended to evaluate test anxiety by evaluating two cognitive dimensions (concern and cognitive interference) and two emotional-physiological dimensions (tension and physiological indicators). In the original analysis conducted by Putwain et al., this four-factor structure was found to be well-suited. In educational systems, exams are a critical component of the academic progression of individuals. This, in turn, results in a progressive escalation of test anxiety, as parents and educational systems place greater expectations and pressure on their performance. The initial step in providing assistance to individuals who experience severe and debilitating anxiety during test preparation and execution can be identified, given the detrimental effects of test anxiety on academic performance. Accurate identification of these individuals necessitates the utilization of suitable instruments. Additionally, it is imperative to evaluate the psychometric properties of an instrument in a novel culture prior to its scientific application. As a result, the objective of the current study was to examine the psychometric properties of the Persian variant of the Multidimensional Test Anxiety Scale (MTAS) among university students.

Objectives

Given the lack of a reliable and valid Persian-language scale for measuring the dimensions of test anxiety, the present study was conducted with the aim of examining the psychometric properties of the Persian version of the Multidimensional Test Anxiety Scale among university students.

Methods

In the academic year 2022, the sample population was comprised of all pupils at Ahvaz Jundishapur University of Medical Sciences. For ten factors, the recommended sample size for confirmatory factor analysis is approximately 200 cases (10, 11). Furthermore, it is recommended that each item have a minimum of 10 participants. Consequently, a convenience sampling method was employed to select 232 participants from this population. To translate the Multidimensional Test Anxiety Scale (MTAS) a conventional backward-forward translation technique was utilized. Initially, it was translated into Persian by a professional translator. Several academic members from Ahvaz Jundishapur University of Medical Sciences' Department of Language assessed the Persian translation. The scale was then back-translated into its original English language by the reviewers. Any differences or inconsistencies were found and fixed after comparing the translated text to the original English text. A pilot sample of 25 participants was then given the Persian MTAS in order to evaluate its general appropriateness for the target audience as well as its clarity and understanding. Any remaining issues or ambiguities were resolved in accordance with the feedback from the pilot testing. The Persian MTAS was prepared for administration to the primary study participants upon its completion. Individuals were required to satisfy the subsequent eligibility requirements in order to participate in the investigation: 1. Enrollment in any undergraduate or postgraduate program at Ahvaz Jundishapur University of Medical Sciences, 2. Willingness to participate in the study procedures and provide informed assent. The process of data collection entailed the self-administration of questionnaires. The questionnaires were disseminated to eligible participants after the institutional review board approved them. Participants were apprised of the study's objectives, the procedures that were to be followed, and their right to withdraw at any time. The participants did not incur any financial costs as a result of their participation in the study. All participants provided informed assent.

Instruments

Multidimensional Test Anxiety Scale: In 2020, Putwain and colleagues (5) devised the Multidimensional Test Anxiety Scale (MTAS), which evaluates four dimensions of test anxiety: Cognitive Interference, Tension, Physiological Indicators, and Worry. The Likert scale is composed of 16 items, each of which is rated on a 5-point scale from strongly disagree (1) to strongly agree (5). Good convergent validity has been demonstrated by the MTAS, which has a positive correlation with measures of test anxiety and an increased risk of mental health issues, and a negative correlation with school well-being. Good divergent validity has also been demonstrated (5). The overall scale exhibited a test-retest reliability of 0.80, while the corresponding scores for Cognitive Interference, Tension, Worry, and Physiological Indicators were 0.65, 0.70, and 0.82, respectively (5).

Frost Multidimensional Perfectionism Scale-Brief (FMPS-Brief): Burgess, Frost, and DiBartolo (12) developed the Frost Multidimensional Perfectionism

Scale-Brief (FMPS-Brief), an 8-item measure of perfectionism that evaluates two dimensions: Evaluative Concerns and Striving Perfectionism.

The Likert scale is a five-point scale that ranges from one to five, with one representing firmly disagree and five representing strongly concur. The subscale scores range from 4 to 20, while the total score ranges from 8 to 40 (12). The total scale has a Cronbach's alpha of 0.83, indicating that it has acceptable psychometric properties (12).

Rosenberg Self-Esteem Scale (RSES): The Rosenberg Self-Esteem Scale (RSES) is a 10-item self-report instrument that assesses global self-esteem. The Likert scale is used to rate each item on a scale of 1 to 4, with 4 representing firmly concur and 1 representing strongly disagree. The total score is between 0 and 40, with higher scores suggesting greater self-esteem. The RSES has exhibited robust psychometric properties. Goldsmith (13) reported a test-retest reliability coefficient of 0.84, which suggests that the scale remains consistent over time. Bernadette, Valery, and Timothy (cited in the original text) reported test-retest reliability coefficients of 0.84, 0.86, and 0.62 for two-week, five-month, and one-year intervals, respectively. These results further underscore the scale's temporal stability. Alizadeh et al. (14) confirmed the scale's reliability by reporting satisfactory internal consistency and test-retest reliability using methodologies such as Cronbach's alpha.

Data Analysis: Using SPSS-25 and confirmatory factor analysis (CFA) with LISREL 8.80, Pearson's correlation was used to examine the data. Various fit indices were used to evaluate the fit of the suggested model: Among the many fit indices used to evaluate the suitability of the suggested model were: X^2/df: A value under 3 suggests a solid model fit. A score over 0.90 indicates an appropriate model fit among NFI, NNFI, CFI, RFI, IFI, and GFI (15, 16). Apart from the above-mentioned fit indices, one should also take into account the general trend of fit indices and the material meaning of the model. A well-fitting model should not only have reasonable fit indices but also make sense conceptually and experimentally.

Results

With a virtually equal gender distribution (127 females, 105 males) and ages spanning from 18 to 47 (average 26.67 years), the research examined data from 232 individuals. With the rest divided between Bachelor's degrees (68.45%) and Master's degrees (48.9%), most participants were single (67.67%) and had postgraduate degrees (82.44%). Anxiety levels were measured using the Multidimensional Test Anxiety Scale MATS (5). Especially, the statistics (Table 1) showed far greater test anxiety ratings for women than for men ($P < 0.05$).

The item-total correlations for the Rosenberg Self-Esteem Scale (RSES) ranged from 0.58 to 0.80.

Pearson's correlation test was used to investigate the correlations among the subscales and with the whole scale. Table 2 reveals significant relationships between the subscales and the overall anxiety scale as well as between the subscales themselves.

This suggests that the subscales are all closely connected and assessing features of the same underlying concept (anxiety).

Reliability Analysis: In order to evaluate the internal consistency or reliability of the MTAS and its subscales, the study implemented Cronbach's alpha. The following alpha coefficients were obtained: the Test Anxiety Scale (0.93), the Worry Subscale (0.88), the Cognitive Interference Subscale (0.81), the Tension Subscale (0.89), and the Physiological Symptoms Subscale (0.83).

Confirmatory Factor Analysis (CFA): In order to evaluate the construct validity of the MTAS, the study implemented confirmatory factor analysis (CFA). The four-factor model of the MTAS is well-suited to the data, as evidenced by the CFA results in Table 3 and Figure 1.

Table 1. Comparison of Test Anxiety Scores in Male and Female Participants

Variable	Gender	N	Mean	SD	t	df	P
Test Anxiety Scores	Female	127	45.10	12.53	4.31	230	0.01
	Male	105	38.06	10.57			

Table 2. Correlations among Subscales and with the Total Scale

Variable	Mean (SD)	1	2	3	4	5
1. Total Anxiety Scale	42.13 (12.22)	1	0.81**	0.80**	0.87**	0.83**
2. Worry	12.48(3.93)		1	0.56**	0.57**	0.52**
3. Cognitive Interference	10.57(3.28)			1	0.60**	0.53**
4. Tension	9.99(3.99)				1	0.71**
5. Physiological Symptoms	9.07(3.51)					1

**Correlation is significant at .01 level.

Table 3. Fit Indices for the Four-Factor Model of the MTAS

Fit indexes	X^2	df	X^2/df	SRMR	GFI	RFI	IFI	CFI	AGFI	NNFI	NFI	RMSEA
Four-Factor	302.45	98	3.08	0.05	0.86	0.93	0.96	0.96	0.80	0.95	0.94	0.08

Convergent and Discriminant Validity: The MTAS demonstrates adequate convergent validity, as evidenced by the significant positive correlations ($P < 0.05$) it demonstrates with measures of perfectionism. This implies that the MTAS is measuring a construct that is associated with other measures of perfectionism. However, the MTAS exhibits substantial negative correlations ($P < 0.05$) with self-esteem measures, indicating that it has adequate discriminant validity. This suggests that the MTAS is not measuring the same construct as self-esteem.

Discussion

Anxiety is a prevalent experience for numerous students in educational environments. Test anxiety, in particular, is a substantial psychological variable that can affect academic performance and overall well-being. The development and validation of exhaustive and reliable assessment tools are essential for comprehending and resolving this issue, as test anxiety is widespread. The literature emphasizes the necessity of assessment instruments that can accurately represent the multifaceted character of test anxiety. The effectiveness of existing instruments in identifying and addressing individual differences in test anxiety experiences may be limited by their inability to adequately encompass all aspects of this complex phenomenon. The objective of this study was to examine the psychometric properties of the MTAS, an instrument that is intended to evaluate the different aspects of test anxiety. The results substantiate the validity and reliability of the MTAS, illustrating its potential for comprehensively measuring test apprehension. Our study's results show that the MTAS and its subscales have high internal consistency. Cronbach's alpha was used to examine internal consistency, obtaining scores of 0.93, 0.88, 0.81, 0.89, and 0.83 for the overall MTAS score, as well as the Worry, Cognitive Interference, Tension, and Physiological Symptoms subscales.

Paton et al. (5) used Cronbach's alpha to assess internal consistency, yielding scores of 0.87, 0.66, 0.88, and 0.82 for the Worry, Cognitive Interference, Tension, and Physiological Symptoms subscales, respectively. Our study has a higher level of internal consistency than Paton's. Furthermore, our results support the four-factor structure of the MTAS proposed by Paton et al. (5). The study's findings showed that the suggested four-factor linked model, which included worry, cognitive interference, tension, and physiological symptoms, suited the data well. This data implies that the MTAS accurately reflects the multidimensional nature of test anxiety. The MTAS's outstanding psychometric features make it an invaluable tool for educators and psychologists. The measure may successfully detect kids who are suffering considerable test anxiety, allowing for prompt interventions and assistance. The MTAS demonstrates a substantial positive connection with indicators of perfectionism. This result corresponds with other studies (17, 18), indicating that persons predisposed to perfectionism are more prone to experiencing test anxiety. The MTAS has a substantial negative connection with self-esteem metrics. This conclusion aligns with other research (19-21), suggesting that those with diminished self-esteem are more susceptible to test anxiety. The relentless pursuit of flawlessness and the propensity to establish excessively high standards for oneself are the defining characteristics of perfectionist students. Additionally, they engage in severe self-criticism of their actions, surpassing the mere completion of assignments. For them, the sole source of gratification is the flawless and complete execution of their responsibilities, rather than simply outperforming their peers. This frequently results in academic decline, procrastination, and the avoidance of responsibilities. Perfectionists demonstrate a substantial inclination to endorse perfectionistic beliefs. These misinterpretations bear a striking resemblance to the negative distortions that are present in anxiety and depression. The process of generalizing failures is exacerbated by the all-or-nothing thinking that is a defining characteristic of perfectionism, which in turn increases anxiety, excitability, and concern in students. A strong sense of self-worth acts as a buffer against the many obstacles, demands, and stresses that people face throughout their lives. It has a big impact on how people see, understand, and react emotionally to things in life. It may also play a significant role in assessing how stressful a scenario is and reducing general anxiety. When faced with challenging and difficult situations in life, those who have a strong sense of self-worth are more resilient and experience less

anxiety. Fostering a strong feeling of self-worth empowers people, which results in improvements like improved academic performance, more self-assurance, and less worry. This encourages a persistent desire for achievement. On the other hand, poor self-esteem leads to a lot of negative ideas, which might make test anxiety worse. Numerous research conducted over the last 20 years have shown a strong correlation between students' levels of perfectionism and test anxiety. A meta-analysis of 20 years of studies on the aspects of test anxiety and perfectionism was carried out by Burcaş et al. There were 22 samples totaling 4,521 people in this meta-analysis. The findings showed that whereas perfectionistic strivings have a slight but non-significant positive link with overall test anxiety (r+ =.04), perfectionistic fears have a moderate to strong positive correlation with total test anxiety (r+ =.42). Nonetheless, there were significant positive associations between cognitive and emotional exam anxiety and both worries and aspirations (18). A cross-sectional study was conducted by Sarı et al. to investigate the relationship between self-esteem and test anxiety in high school pupils. The study involved seven hundred twenty-four secondary school students who were preparing for university entrance exams. Sarı et al.'s study's principal findings suggest that gender is a factor in test anxiety, and there is a negative correlation between self-esteem scores and test anxiety levels. It was noted that female students experienced a greater degree of test anxiety than their male counterparts, and students who reported higher levels of self-esteem reported lower levels of test anxiety. This measure may provide a novel quantitative methodology for literature and furnish essential data for further intervention study on kids' test anxiety. Subsequent results derived from data gathered using this scale may be used by health administrators to formulate plans for enhancing student health. This research may augment understanding of the cultural influences on the concept of anxiety and improve its external validity.

Conclusion

The standardization of the Multidimensional Test Anxiety Scale (MTAS) offers researchers expanded opportunities to investigate and study test anxiety without sacrificing quality or accuracy. The MTAS exhibits satisfactory reliability and validity, as indicated by the results. The results of this investigation have the potential to enhance the cross-cultural literature on the MTAS. The Multidimensional Test Anxiety Scale (MTAS) is a simple instrument for doing research in big populations and achieving exploratory aims. Further research is required to investigate its validity and dependability in a variety of scenarios, therefore accumulating greater proof of its value. The research has significant drawbacks. We do not have data on how the Multidimensional Test Anxiety Scale (MTAS) performs in other groups. Future study is required to replicate the MTAS's performance in other scenarios using different sampling methods. This study's sample size was limited to students from a single institution in Ahvaz. Future studies should broaden the area of study by gathering data from numerous places and demographics. Correlational investigations with linked psychological dimensions may help to enhance item content validity. Self-report surveys may be influenced by social-cultural desirability and recollection biases. Our sample size was modest, but adequate for powerful factor analysis using common criteria. We also did not analyze test-retest reliability, thus the stability over time is a relevant subject for future study. Data were obtained using self-report techniques, which have the potential to compromise validity due to participant inattention, misrepresentation, desirability bias, and self-selection bias.

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References

1. Von der Embse N, Jester D, Roy D, Post J. Test anxiety effects, predictors, and correlates: A 30-ear meta-analytic review. J Affect Disord. 2018 Feb:227:483-493. doi: 10.1016/j.jad.2017.11.048. [PMID: 29156362]
2. Herzer F, Wendt J, Hamm AO. Discriminating clinical from nonclinical manifestations of test anxiety: A validation study. Behav Ther. 2014 Mar;45(2):222-31. doi: 10.1016/j.beth.2013.11.001. [PMID: 24491197]
3. Benson J, Moulin-Julian M, Schwarzer C, Seipp B, El-Zahhar N. Cross validation of a revised test anxiety scale using multi-national samples. Advances in test anxiety research. 1992;7:62-83.
4. Spielberger CD. Test Anxiety Inventory. In The Corsini Encyclopedia of Psychology. New Jersey: John Wiley & Sons; 2010: 1. doi: 10.1002/9780470479216.corpsy0985

5. Putwain DW, von der Embse NP, Rainbird EC, West G. The development and validation of a new Multidimensional Test Anxiety Scale (MTAS). European Journal of Psychological Assessment. 2020; 37: 236-46. doi:10.1027/1015-5759/a000604.
6. Spielberger CD, Vagg PR. Test anxiety: A transactional process model. In: Spielberger CD, Vagg PR, (Eds.). Test anxiety: Theory, assessment, and treatment. Washington: Taylor & Francis; 1995: 3–14.
7. Endler NS, Kocovski NL. State and trait anxiety revisited. J Anxiety Disord. 2001; 15(3):231-45. doi: 10.1016/s0887-6185(01)00060-3. [PMID: 11442141]
8. Mandler G, Sarason SB. A study of anxiety and learning. J Abnorm Psychol. 1952 Apr; 47(2): 166-73. doi: 10.1037/h0062855. [PMID: 14937950]
9. Liebert RM, Morris LW. Cognitive and emotional components of test anxiety: A distinction and some initial data. Psychol Rep. 1967 Jun;20(3):975-8. doi: 10.2466/pr0.1967.20.3.975. [PMID: 6042522]
10. Kline RB. Principles and practice of structural equation modeling. 3rd ed. New York: Guilford Press; 2011.
11. Shah R, Goldstein SM. Use of structural equation modeling in operations management research: Looking back and forward'. Journal of Operations Management. 2006; 24(2): 148–69. doi:10.1016/j.jom.2005.05.001.
12. Burgess AM, Frost RO, DiBartolo PM. Development and validation of the Frost Multidimensional Perfectionism Scale-Brief. Journal of Psychoeducational Assessment. 2016; 34(7):620-33. doi:10.1177/0734282916651359.
13. Goldsmith RE. Dimensionality of the Rosenberg self-esteem scale. Journal of social Behavior and Personality. 1986; 1(2):253.
14. Alizadeh T, Farahani MN, Shahraray M, Alizadegan Sh. The relationship between self esteem and locus of control with infertility related stress of no related infertile men and women. J Reprod Infertil. 2005;6(2):194-204. [In Persian]
15. Hooper D, Coughlan J, Mullen M. Structural equation modelling: Guidelines for determining model fit. New York: University Press of America; 2008:2.
16. Meyers LS, Gamst G, Guarino AJ. Applied multivariate research: Designs and interpretation. 2nd ed. Los Angeles, US: 2013.
17. Eum K, Rice KG. Test anxiety, perfectionism, goal orientation, and academic performance. Anxiety Stress Coping. 2011 Mar;24(2):167-78. doi: 10.1080/10615806.2010.488723. [PMID: 20503124]
18. Burcaş S, Creţu RZ. Multidimensional perfectionism and test anxiety: A meta-analytic review of two decades of research. Educational Psychology Review. 2021;33(1):249-73. doi: 10.1007/s10648-020-09531-3.
19. Park HJ, Byun EK. Effect of perceived stress, self esteem, major satisfaction on the test anxiety of nursing students. The Journal of the Convergence on Culture Technology. 2021;7(1):194-201.
20. Hyseni Duraku Z, Hoxha L. Self-esteem, study skills, self-concept, social support, psychological distress, and coping mechanism effects on test anxiety and academic performance. Health Psychol Open. 2018 Sep 12;5(2):2055102918799963. doi: 10.1177/2055102918799963. [PMID: 30225094] [PMCID: PMC6136113]
21. Sarı SA, Bilek G, Çelik E. Test anxiety and self-esteem in senior high school students: a cross-sectional study. Nord J Psychiatry. 2018 Feb;72(2):84-88. doi: 10.1080/08039488.2017.1389986. [PMID: 29037120]

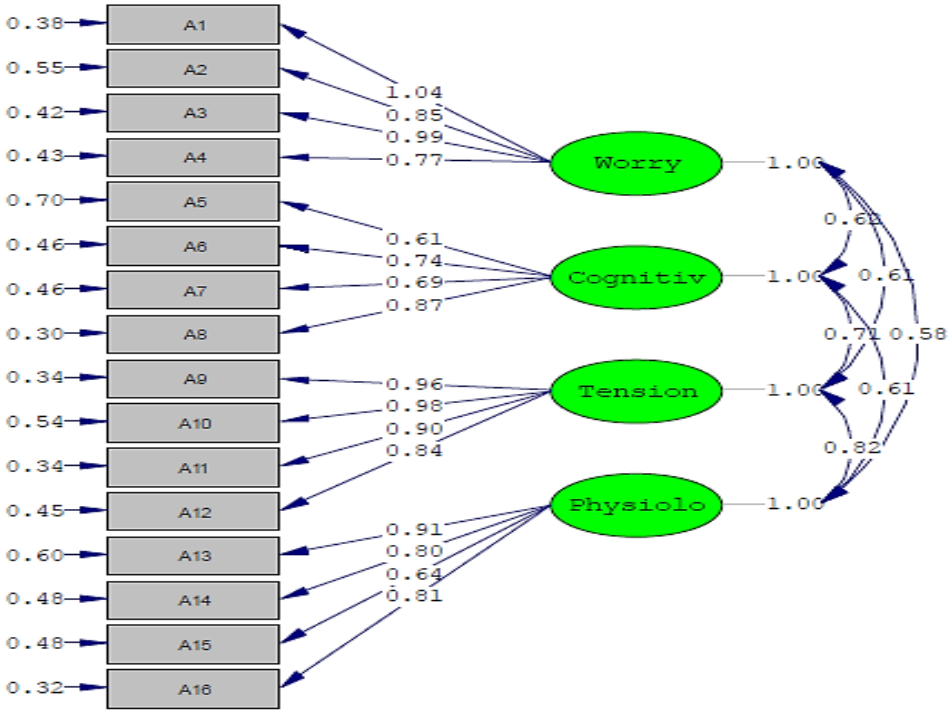

Figure 1. Four -Factor model of Multidimensional Test Anxiety Scale (MTAS)

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Original Article

The Relationship between Academic Learning Effectiveness and the Desire for Lifelong Learning in Dental Students

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Abstract

Background: Rapid global changes in various fields have made the need for lifelong learning of students an important issue. Efficient models have been developed to predict learning effectiveness and three categories of academic factors, social/environmental and personality factors have been recognized. This study was designed to identify these factors and their relationship with students' desire for lifelong learning.

Objectives: Identify factors of learning effectiveness and measuring their relationship with students' desire for lifelong learning can provides a foundation for adjusting them to improve the learning experience.

Methods: This cross sectional descriptive-analytical research was done on the students of the Kerman School of Dentistry in 2024-2025. The tools used in this research were the College Learning Effectiveness Inventory (CLEI) questionnaire and a researcher made questionnaire for lifelong learning. Descriptive statistics were used to describe quantitative data, Pearson's correlation test was used for data analysis using SPSS 27 software.

Results: The results showed that by increasing the effectiveness of university learning, the desire for lifelong learning among the students increases ($p<0.001$, $r= 0.596$). This relationship was increasing and at an average level in all surveys related to gender, academic year, university admission condition, marital status and place of residence. There is no significant relationship between self-regulation ability and stress and anxiety, as well as between self-regulation and emotional satisfaction with education and professors ($p>0.05$). The relationship between the rests of the investigated components is significant and incremental. The strongest relationship was related to academic self-efficacy and self-management ($p<0.001$, $r=0.655$).

Conclusion: Increasing the effectiveness of students' learning can increase students' desire for lifelong learning by considering the social and individual dimensions of students, and this issue should be considered by policymakers and educational planners.

Keywords: Academic; Life-long learning; Students; Dental

Background

Rapid global changes in diverse fields have made the need for lifelong learning among students an essential and fundamental issue. The concept of lifelong learning was first officially introduced in 1971 and was later emphasized in UNESCO reports in 1972 and 1996 (1, 2). Lifelong learning has directly influenced the development and reform of educational systems, and has indirectly impressed fields such as science and technology, economics, culture, and social development (3). Lifelong learning is defined as learning that takes place throughout life. It is flexible, diverse, and accessible at various times and places. In this type of learning, there are no limitations in terms of place, time, age, or educational level (4). Lifelong learning is based on individual needs and aims to respond to the real needs of people at different stages of life (5). Expanding lifelong learning on a continuous, collaborative,

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sustainable, and applicable basis poses challenges for most educational systems. Addressing these challenges constructively sometimes requires changes in the way educators teach and, consequently, in the learning styles of students, so that learning occurs more effectively (6). To achieve lifelong learning, policies need to focus on creating equal and continuous learning opportunities, flexibility in accepting returning students, and diversification of educational programs (7). Bayraki and Dinar identified five key factors: curiosity, motivation and desire to learn, access to various information resources, self-direction, and self-evaluation, all of which play a significant role in lifelong learning (8). There are also various institutional, educational, and personal barriers to lifelong learning. Institutional and educational barriers are easier to overcome than personal challenges. By changing management styles, teaching methods, and developing specific and targeted programs, institutional and educational problems can be reduced. However, addressing personal challenges requires greater effort to enhance student independence and self-direction (9).

As mentioned above, learning and academic achievement are the most challenging topics in educational psychology, and several effective models have been developed to predict it (10). Russell and Petri (11) identified factors used to measure students' strengths and weaknesses, and developed the College Learning Effectiveness Inventory (CLEI) based on these factors. Some scholars argue that 50 percent of academic performance is determined by innate talent, 10 percent by environmental factors, and the remaining 40 percent by individual variables (12). Thus, half of academic performance is influenced by factors beyond a student's natural ability, which the CLEI aims to evaluate.

Demirel in his study concluded that to achieve lifelong learning, the curriculum should emphasize skills training, fostering sustainable life values, personal growth, and self-esteem (13). Rezaian et al. in a research among medical students in Rafsanjan, showed that lifelong learning of students was relatively desirable. Girls' learning scores in this study were higher than boys' (14). In the study by Havasi et al. at Razi University, students' desire for lifelong learning was also moderate (15). In another study, Dergisi showed that engineering students tend to adopt lifelong learning approaches (16). In all of these studies, researchers examined students' desire to engage in lifelong learning and only Mashaghi et al. (17) documented its relationship with academic achievement.

In the Russell and Petri model and later revised versions, three main categories of factors affecting student learning are identified: academic factors, social/environmental factors, and personality factors (8). The present study was designed to identify these factors and measuring their relationship with students' desire for lifelong learning which can provides a foundation for adjusting them to improve the learning experience.

Objectives

Along with improving the learning experience, informed policy-making based on the expertise and knowledge of the organization's strategic resources can be achieved.

Methods

The participants of this cross sectional descriptive-analytical study was consisted of students from the Kerman dental school. The sampling method was a census, and inclusion criteria included student consent to participate in the study. Residents were not included. Of the 298 dental students, 216 (72.4%) students participated in this study. All of the responses in two questionnaires were the same, so they were excluded from the study. The questionnaires were distributed to students during the daily breaks at the college, and they were asked to fill them out carefully at home or in their dormitories. The completed questionnaires were collected the following day. Two questionnaires were used for this study.

A. College Learning Effectiveness Inventory (CLEI) Questionnaire

This questionnaire is derived from previous studies (11, 18). It evaluates six aspects of academic learning: academic self-efficacy, organization and attention in study, stress and time pressure, engagement in academic activities, emotional satisfaction, and classroom communication (11). In Moshtaghi study (19), the original questionnaire was translated from English to Persian. To ensure the accuracy of the translation and the consistency of the two English and Persian versions, the Persian translation was provided to two people fluent in Persian and English to reverse translate it back to English. Then it was translated back to Persian again. Finally, its face and content validity were determined by experts. Its construct validity and reliability were also calculated.

Construct validity of Persian translated CLEI questionnaire was evaluated via exploratory factor analysis and confirmatory factor analysis and it was reported as desirable. The reliability of this tool was reported by Cronbach's alpha coefficients for the six scales ranging between 0.66 and 0.84.

The questionnaire consists of 50 questions on a five-point Likert scale ; 14 for academic Self-efficacy, 8 for study organization, 6 for stress and Anxiety, 9 for university Activities, 7 for emotional satisfaction and 6 questions for classroom communication. Total score ranges from 50 (for all answers "I completely disagree") to 250 (for all answers "I completely agree"). Academic Self-efficacy; 14-70, Study organization; 8-40, Stress and Anxiety; 6-30, university Activities; 9-45, emotional satisfaction; 7-35, and classroom communication; 6-30.

The following scale was used to categorize the total scores from the CLEI questionnaire based on the effectiveness of academic learning:

- *Excellent (total score 200 to 250):* Indicates high effectiveness in academic learning.
- *Good (total score 150 to 199):* Indicates good effectiveness in academic learning.
- *Average (total score 100 to 149):* Indicates moderate effectiveness in academic learning.
- *Low (total score 50 to 99):* Indicates low effectiveness in academic learning.
- *Poor (total score below 50):* Indicates very low effectiveness in academic learning.

B. Lifelong Learning Orientation Questionnaire

This researcher made questionnaire measures seven dimensions: self-management, meta-learning (learning how to learn), initiative and innovation, information-gathering ability, decision-making ability, self-regulation, and self-control (20). These dimensions are assessed using 57 questions on a five-point Likert scale (completely disagree = 1 to completely agree = 5).

In Bordbar research (20), to measure the validity of the questionnaire, the correlation coefficient between the items of each scale was calculated with the total score of the corresponding scale using the item analysis method. The innovation and entrepreneurship dimension has the highest correlation coefficient (0.81) and the data collection dimension shows the lowest correlation coefficient (0.64).

To evaluate content validity, we asked 10 dental specialist to determine the appropriateness of each question. The responses to each question were calculated and the content and face validity ratios (CVR and CVI) were calculated based on the relevant formula. The score of content validity was above 0.79.

We used convergent validity and discriminant validity to evaluate the construct validity of the questionnaire. The average correlation of items in each dimension was high and significant (above 0.4) (Table1) which was the evidence for convergent validity. The results for discriminant validity also are presented in table 2.

In the Bordbar study (20), all dimensions had high and desirable reliability (Cronbach's alpha: 0.82), in other words, his study shows that the questionnaire has high internal consistency. We also examined the reliability using the test-retest method.

For this purpose, the questionnaire was completed by 25 students who had similar characteristics to the statistical population of the present study, and the scores for each person were calculated. After a two-week interval, the same students from the first round were referred again, and after completing the questionnaires, the scores were calculated and finally, the correlation coefficient between the scores of the first and second rounds as an index of test-retest reliability was obtained at a desirable value of 0.79.

Scoring of the Questionnaire

The questionnaire consists of 57 questions on a five-point Likert scale; 10 for self-management, 8 for meta-learning, 8 for initiative and Innovation, 11 for information gathering, 4 for decision-making ability, 9 for self-regulation, 7 for self-control. Total score ranges from 57 to 258. Self-management; 10-50, meta-learning; 8-40, initiative and Innovation; 8-40, information gathering; 11-55, decision-making ability; 4-20, self-regulation; 9-45, and self-control; 7-35.

- *Score between 57 and 95:* Indicates a low tendency for lifelong learning among students.
- *Score between 95 and 190:* Indicates a moderate tendency for lifelong learning among students.
- *Score higher than 190:* Indicates a high tendency for lifelong learning among students.

Data analysis was conducted using the SPSS version 27 software. For all research variables, the critical ratio of the coefficient of skewness and kurtosis was within the range of +2.58 and -2.58; therefore, all data in the present study followed a normal distribution. Descriptive statistics were employed to describe the quantitative data, while Pearson's correlation test was

used to analyze relationships between quantitative variables. The significance level was set at 0.05.

Results

The findings showed that 48.4% of the students were female, 39.3% were single, 55.6% were native, and 72.9% were non- tuition-paying students (Table 3).

In this study, 3 students (1.4%) rated the effectiveness of academic learning as low, 50 students (23.4%) as average, 146 students (68.2%) as good, and 15 students (7.0%) as excellent. Additionally, the desire for lifelong learning in 46 students (21.5%) was moderate, while it was high in 168 students (78.5%) (Table 4).

The results of the Pearson correlation test showed a significant relationship between the effectiveness of academic learning and the desire for lifelong learning (p-value < 0.05, Pearson correlation = 0.596). This relationship was direct and of moderate strength. In other words, as figure 1 illustrates, an increase in the effectiveness of academic learning leads to an increase in the desire for lifelong learning among Kerman dental students.

The results also showed a significant relationship between the effectiveness of academic learning and the desire for lifelong learning across gender, academic year, marital status, type of university admission, and residency status (P < 0.05). This relationship is positive (direct) and of moderate strength in all cases (P < 0.05) (Table 5).

The results of Pearson's correlation tests in Table 6 indicate that there is no significant relationship between self-regulation capability and stress/anxiety, nor between self-regulation and emotional satisfaction with teaching and professors (classroom communication) (p > 0.05). However, the relationship between the remaining components is significant and positive. The strongest relationship was found between academic self-efficacy and self-management (r = 0.655).

Discussion

The present study was designed to assess the relationship between the effectiveness of academic learning and the desire for lifelong learning. The results showed that the effectiveness of academic learning in 75% of the students was good or excellent. Additionally, the desire for lifelong learning was moderate in 21.5% of students and high in 78.5% of them. The relationship between the effectiveness of learning and the desire for lifelong learning was positive and incremental. Moreover, this positive relationship held true across gender, academic year, type of university admission, marital status, and residency status. The results of the study by Yap and Tan showed that awareness, gender, and level of study did not significantly affect lifelong learning, which does not align with the findings of the present study (21). Furthermore, the results revealed that as most components of learning effectiveness increased, the components of lifelong learning also improved. However, no significant relationship was found between stress and anxiety with self-regulation ability, nor between emotional satisfaction with education and professors with self-regulation ability.

Higher academic self-regulation allows individuals to better control their thoughts, emotions, and ultimately their behavior. Therefore, students with high levels of academic self-regulation tend to complete their tasks more effectively and are less likely to procrastinate. Stress, anxiety, and negative emotions, on the other hand, decrease an individual's self-regulation abilities (19).

The results showed that the strongest correlation was between academic self-efficacy and self-management. Students' self-efficacy beliefs enable them to manage their studies and make progress by trusting in their ability to succeed (14). Moreover, self-control and management play a crucial role in personal growth, goal achievement, satisfaction, competence, strengthening self-confidence, and resilience in the face of challenges, all of which are important factors in fostering a desire for lifelong learning (21). To date, no other study has examined the relationship between academic learning effectiveness and the desire for lifelong learning in students, making this study the first to investigate this relationship. Only one study conducted on students at Dezful University of Medical Sciences, found a positive relationship between the factors influencing academic learning and academic achievement (17). In a study by Rezaian et al. in Rafsanjan (14), similar to the present study, the desire for lifelong learning was rated as high, whereas in a study at Razi University in Kermanshah, this level was reported as moderate (15). The dependence of the concept of lifelong learning on various fields and the influence of cultural and educational factors has been emphasized in numerous studies (3, 22). Senior managers and policymakers must consider lifelong learning when conceptualizing, developing mechanisms, and creating operational plans for an educational system with a lifelong learning approach. At the same time, different

priorities exist globally among healthcare system officials and academic institutions regarding lifelong learning, influenced by political perspectives, public opinion, and organizational factors that shape the lifelong learning needs of healthcare professionals (23).

A report by the UNESCO Commission on Lifelong Learning in Iran indicates that creating a lifelong learning system is a political process that requires political courage, strong commitment, and a progressive spirit. It necessitates the participation of stakeholders in governance and decision-making centers, along with coordination in policy-making. The design and implementation of the program within the Ministry of Health should involve collaboration with other stakeholders, including universities (24). The foundation of lifelong learning should be a primary concern for dental schools. In alignment with this perspective, Kazu emphasizes that the success of lifelong learning depends not only on government policies but also on universities' responsibilities to teach and guide students in their research while addressing their long-term learning needs (25). From the moment students enter the university, they should be guided in learning skills and provided with educational programs that reinforce these skills. Without a structured approach in the college environment, individual professors alone cannot achieve this goal. In other words, achieving lifelong learning requires universities to develop curricula that foster lifelong learning by reviewing and enhancing their existing learning and teaching processes. Universities should design their curricula so that students can take control of their own learning and research responsibilities (17). One way to achieve these objectives is by improving students' learning effectiveness through efforts to enhance the factors of learning effectiveness. Research shows that while individuals' self-efficacy is influenced by various factors, it can be enhanced through appropriate assignments, such as project-based tasks. Additionally, employing new educational methods in universities, such as problem-based learning and collaborative learning, and using student-centered educational approaches that involve cooperation between faculty and students, creating a teamwork-oriented environment in student activities, promoting supportive clinical relationships with encouraging feedback rather than criticism, and introducing modern clinical teaching approaches can positively affect students' attitudes towards the educational environment and their participation in academic activities, ultimately improving their learning outcomes (26, 27). Moreover, assessing various aspects of learning environments can contribute to the further development of educational services and better educational programs (28). Using different study strategies, teaching stress management techniques and considering different individual and environmental factors can train independent and efficient learners who will accept the responsibility of their own learning.

Limitations: Due to the dispersion of general dentistry students in different departments, it was not easy to reach them. We tried to overcome this limitation by visiting them during break hours or after theoretical classes. On the other hand, it was not easy to convince students to fill out two questionnaires patiently.

Conclusion

According to the results of this study, increasing the effectiveness of students' learning by addressing both the social and individual dimensions can enhance various components of learning effectiveness and, in turn, increase students' desire for lifelong learning. Therefore, structures such as educational self-efficacy, teaching new study methods, employing innovative teaching approaches, and encouraging student participation in social and academic activities should be prioritized by policymakers and education planners.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The study was confirmed by the Ethics Committee of the Kerman University of Medical Sciences (Code IR.KMU.REC.1401.484). All student information will remain confidential, with no names being disclosed.

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References

1. Schuller T, Rubenson K, Brink S, Sabates R. 3rd Global Report on Adult Learning and Education. Hamburg, Germany: Unesco Institute for Lifelong Learning; 2016: 18-21.
2. Singh JD. Higher Education in Promoting Lifelong Learning in India: Issues and Challenges. Proceedings of the 3rd International Conference «Empowering Lifelong Education and Learning for Human Security; 2015 Aug 1; Bangkok, Thailand. 2015.

3. Wang X, Hu Q. Research into the Improvement of College Students' Life-Long Learning Ability. Creative Education. 2012; 3(7):69-72. doi:10.4236/ce.2012.37B017.
4. Uzunboylu H, Selcuk G. Lifelong Learning Competency Perceptions of Teacher Candidates According to a Teacher Training Program. Anthropologist. 2016; 24(1):119-25. doi: 10.1080/09720073.2016.11891997.
5. Ozen R, Ozturk DS, Ozturk F. The Relationship between Pre-service Teachers' Lifelong Learning Tendencies and the Quality of University Life. Anthropologist. 2016; 24(1): 105-12. doi:10.1080/09720073.2016.11891995.
6. Collins J. Lifelong learning in the 21st century and beyond. Radiographics. 2009 Mar-Apr;29(2):613-22. doi: 10.1148/rg.292085179. [PMID: 19325069]
7. Kamyabi M, Foroughi Abari AA, Yarmohammadian MH. Desirable Features of Higher Education Policies with an Emphasis on Lifelong Learning Approach: Faculty Members' Perspective. Iran J Med Educ. 2017; 17: 38-49. [In Persian]
8. Bayrakçı M, Dindar H. Factors Effecting Students' Lifelong Learning in Higher Education. Int. J. Lifelong Educ. International Journal on Lifelong Education and Leadership. 2015; 1(1): 11–20. doi:10.25233/ijlel/2015-v1i1p2.
9. Yang J, Schneller Ch, Roche S. The role of higher education in prompting lifelong learning. 1st ed. Hamburg: UNESCO Institute for Lifelog Leanring; 2015: 147-60.
10. Newton FB, Kim E, Wilcox D, Beemer N. Administration and scoring manual for the college learning effectiveness inventory (CLEI). Manhattan, UA: Kansas State University; 2008.
11. Russell RK, Petrie TP. Academic adjustment of college students: Assessment and counseling. In: Brown SD, Lent RW. (Eds.). Handbook of Counseling Psychology. New York: Wiley; 1992: 48-50.
12. Stott A, Hobden PA. Effective Learning: A Case Study of the Learning Strategies Used by a Gifted High Achiever in Learning Science. Gifted Child Quarterly. 2016; 60(1): 63-74. doi:10.1177/0016986215611961.
13. Demirel M. Lifelong learning and schools in the twenty-first century. Procedia Social and Behavioral Sciences. 2016;1(1): 1709–16. doi:10.1016/j.sbspro.2009.01.303.
14. Rezaian M, Shahrabadi E, Haghdoost AA. Evaluation of lifelong learning in students of Rafsanjan University of Medical Sciences in 2013. Proceedings of the 15th Medical Education Conference; 2014 Apr 9-11; Yazd, Iran. 2014. [In Persian]
15. Havasi M, Alibeigi A, Taghibeigi M. Students' Desire for Lifelong Learning and Factors Affecting It: Application of Bandura's Social Cognitive Theory. Higher Education Letter. 2023; 16 (64): 49-76. [In Persian]
16. Deveci Tanju. Lifelong Learning Orientations of Freshman Engineering Students and Faculty Members. Yükseköğretim Dergisi. 2014; 4(1):14-22. doi:10.2399/yod.14.001.
17. Moshtaghi S, Afzalzadeh M. The Relationship of Learning Effectiveness Factors and Academic Achievement in Dezful University of Medical Sciences Students. Journal Medical Education Development. 2016; 9(23): 74-82. [In Persian]
18. Kim E, Newton FB, Downey RG, Benton SL. Personal factors impacting college student success: Constructing college learning effectiveness inventory (CLEI). College Student Journal. 2010; 44 (1): 112-25.
19. Moshtaghi S. Evaluation the psychometric indicators of the questionnaire Student Learning Effectiveness (CLEI). Psychological methods and models. 2014; 14(4): 91-105. [In Persian]
20. Bordbar N. Investigating the relationship between academic innovation and students' tendency to lifelong learning through the mediation of faculty members' skills in the teaching and learning process at Shiraz University. (Dissertation). Shiraz: Shiraz University; 2016: 31-5. [In Persian]
21. Yap JS, Tan J. Lifelong learning competencies among chemical engineering students at Monash University Malaysia during the COVID-19 pandemic. Education for Chemical Engineers. 2021; 38:60–69. doi: 10.1016/j.ece.2021.10.004.
22. Slowey M, Schütze HG. Global Perspectives on Higher Education and Lifelong Learners. 1st ed. New York: Routledge; 2012: 211-4. doi:10.4324/9780203122495.
23. Coşkun YD, Demire M. Lifelong learning tendencies of university students. Hacettepe Universitesi Egitim Fakultesi Dergisi-Hacettepe University Journal of Education. 2012; 42: 108-20.
24. Iranian National Commission for UNESCO. National Training Workshop on Innovative Concepts and Systems of Lifelong Learning. Tehran: Ministry of Education; 2013: 44. [In Persian]
25. Kazu H, Demiralp D. Faculty Members' Views on the Effectiveness of Teacher Training Programs to Upskill Life-Long Learning Competence. Eurasian Journal of Educational Research. 2016; 16 (63): 205-24.
26. Mohamadi A, Mohamadi J. Students' Perception of the Learning Environment at Zanjan University of Medical Sciences. Journal of Medical Education Development. 2013; 11(6): 50-60. [In Persian]
27. Modami M, Rohani B, Mohammadimehr M. Exploring Dental Students' Experiences of Clinical Education: A Qualitative Study. Strides Dev Med Educ. 2025; 22(1):e1449.
28. Salari Z, Horri A, Tahmasbi A, Shojayeepour R, Jahanimoghadam F. Evaluation of the Clinical Learning Environment (CLE) Using the Postgraduate Hospital Educational Environment Measure (PHEEM) in Viewpoint of Dental Residents: A Multicenter Study in Iran. Strides Dev Med Educ. 2023; 20(1):66-74. doi:10.22062/sdme.2023.198063.1137.

Table 1. Average correlation of items in each dimension of lifelong learning

Items	Average correlation items in each dimension
Self-management	0.629
Meta-learning	0.695
Initiative and Innovation	0.529
Information gathering	0.687
Decision making ability	0.516
Self-regulation	0.687
Self-control	0.603

Table 2. Correlation of dimensions of the lifelong learning questionnaire

Variable	Self-management	Meta-learning	Initiative & Innovation	Information gathering	Decision making ability	Self-regulation	Self-control
Self-management	Correlation coefficient	0.347	0.422	0.364	0.351	0.431	0.443
	p-value	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Meta-learning	Correlation coefficient	-	0.312	0.337	0.376	0.336	0.362
	p-value		<0.001	<0.001	<0.001	<0.001	<0.001
Initiative & Innovation	Correlation coefficient	-	-	0.403	0.152	0.421	0.432
	p-value			<0.001	<0.001	<0.001	<0.001
Information gathering	Correlation coefficient	-	-	-	0.301	0.325	0.410
	p-value				<0.001	<0.001	<0.001
Decision making ability	Correlation coefficient	-	-	-	-	0.428	0.366
	p-value					<0.001	<0.001
Self-regulation	Correlation coefficient	-	-	-	-	-	0.370
	p-value						<0.001
Self-control	-	-	-	-	-	-	-

Table 3. Demographic information of the study participants

Variable	Number (Percentage)
Gender	
Female	104 (48.4)
Male	110 (51.6)
Year of Study	
First year	26 (12.1)
Second year	32 (14.9)
Third year	42 (19.7)
Fourth year	35 (16.3)
Fifth year	33 (15.4)
Sixth year	46 (21.6)
Marital Status	
Single	191 (89.3)
Married	23 (10.7)
University Admission	
Tuition-Paying	58 (27.1)
Tuition-Free	156 (72.9)
Residency Status	
Native	119 (55.6)
Non-native	95 (44.4)

Table 4. Distribution of Students' Opinions on the Studied Criteria

		Number (Percentage)
Effectiveness of Academic Learning	low learning effectiveness	3 (1.4)
	Medium learning effectiveness	50 (23.4)
	Good learning effectiveness	146 (68.2)
	Excellent learning effectiveness	15 (7.0)
	Total	214 (100)
Desire for lifelong learning	Moderate desire for lifelong learning	46 (21.5)
	High desire for lifelong learning	168 (78.5)
	Total	214 (100)

Table 5. Relationship between the effectiveness of academic learning and the desire for lifelong learning based on demographic information

Variable	Lifelong Learning	Academic Learning Effectiveness				95% CI	
		Pearson's correlation coefficient	p-value	Number	Relationship	Lower	Upper
Gender	Female	0.598	<0.001	104	Direct	0.463	0.706
	Male	0.594	<0.001	110	Direct	0.452	0.706
Academic Year	First year	0.656	<0.001	26	Direct	0.352	0.835
	Second Year	0.469	<0.001	32	Direct	0.138	0.706
	Third Year	0.726	<0.001	42	Direct	0.539	0.845
	Forth Year	0.569	<0.001	35	Direct	0.285	0.761
	Fifth Year	0.428	0.014	33	Direct	0.094	0.676
	Sixth Year	0.752	<0.001	46	Direct	0.589	0.857
Marital Status	Single	0.622	<0.001	191	Direct	0.527	0.702
	Married	0.460	0.031	23	Direct	0.047	0.738
University Admission	Tuition-Paying	0.550	<0.001	58	Direct	0.340	0.708
	Tuition-Free	0.615	<0.001	156	Direct	0.507	0.704
Residency Status	Native	0.655	<0.001	119	Direct	0.533	0.751
	Non-Native	0.524	0.031	95	Direct	0.354	0.661

CI: Confidence Intervals

Table 6. Correlation of Academic Learning Effectiveness Components and the Desire for Lifelong Learning among Kerman Dental Students

	Self-Control	Self-regulation	Decision-making ability	Information Gathering	Initiative and Innovation	Meta Learning	Self-Management
Academic Self-efficacy	0.453**	0.414**	0.425**	0.501**	0.531**	0.601**	0.655**
Study Organization	0.311**	0.227**	0.352**	0.328**	0.409**	0.447**	0.407**
Stress and Anxiety	0.151*	0.037	0.170*	0.361**	0.358**	0.263**	0.271**
University Activities	0.255**	0.324**	0.225**	0.309**	0.425**	0.236**	0.388**
Emotional Satisfaction with Teaching and Professors	0.269**	0.105	0.263**	0.395**	0.410**	0.362**	0.380**
Classroom Communication	0.277**	0.163*	0.342**	0.264**	0.370**	0.329**	0.350**

*The relationship is significant at the 0.05 level, **The relationship is significant at the 0.01 level.

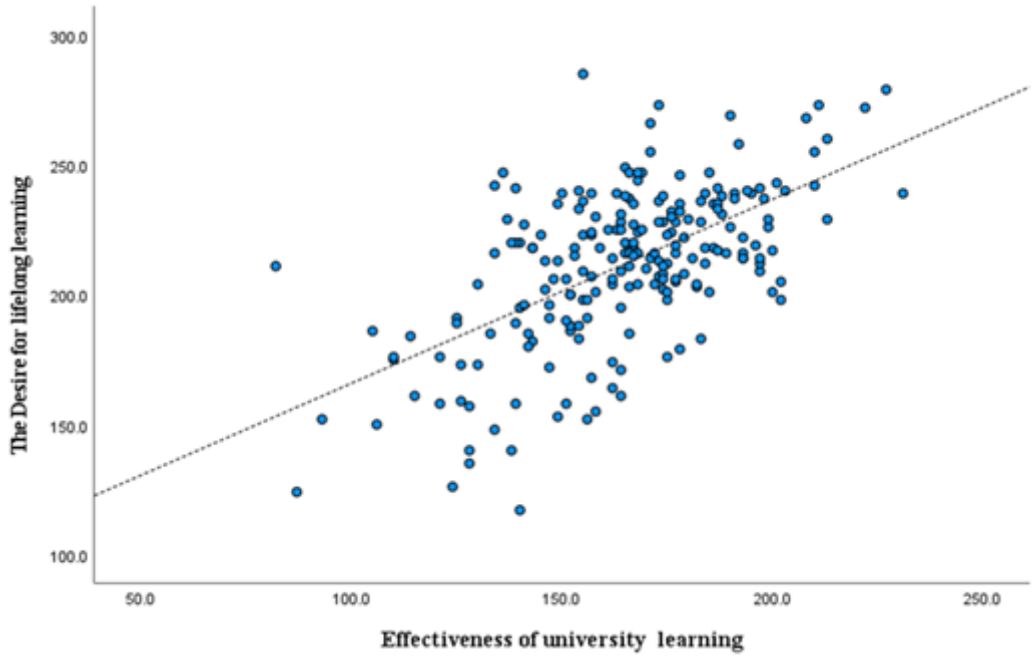

Figure 1. Distribution of the Effectiveness of Academic Learning and the Desire for Lifelong Learning

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Letter to editor

Breaking the Glass Ceiling: Women Leaders in Education

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Keywords: Educational Leadership; Women in Leadership; Gender and Leadership

Dear Editor,

Leadership is a multifaceted concept that entails the ability of an individual, group, or organization to guide, influence, and inspire others. It involves driving outcomes and facilitating collective efforts to achieve objectives beyond individual capacity (1). However, leadership is not a gender-neutral phenomenon; somewhat, it is shaped by societal expectations and institutional structures (2, 3). Women face systemic barriers, including biased perceptions of their leadership competence, limited access to leadership roles, and the enduring influence of traditional gender norms (3). Research indicates that traits historically associated with effective leadership—such as decisiveness, assertiveness, and authority—are often linked with masculinity, creating implicit biases that disadvantage women (2-4). These structural and cultural barriers underscore the need to examine educational leadership through a gendered lens (3, 4).

Cultural contexts further shape leadership opportunities for women. Gender norms, traditional roles, and institutional frameworks influence career trajectories, often reinforcing existing biases (1-3). A comprehensive understanding of these cultural factors provides a foundation for addressing gender-related challenges and enhancing women's contributions to educational leadership (3, 4). Gender also affects perceptions of leadership styles, hiring decisions, workplace interactions, and career advancements (2-4). Women are frequently evaluated based on communal traits such as empathy and collaboration, while men are assessed on agentic traits like decisiveness and risk-taking (1, 3). These biases influence performance evaluations, promotion opportunities, and institutional investments in female leaders (3, 4). Addressing these barriers requires policies that challenge traditional leadership norms and foster an equitable environment for women in leadership (2, 4, 5).

Educational leadership focuses on developing influential leaders who shape policies and programs to drive student success and benefit communities (1, 2). However, leadership opportunities within educational institutions are influenced by gender norms and institutional structures, often reinforcing preexisting biases (2, 3). Understanding these cultural factors is essential for addressing gender-related challenges in educational leadership (3, 4).

Despite these challenges, women in educational leadership play a crucial role in fostering inclusive and dynamic learning environments. Their strengths in empathy, collaboration, and effective communication contribute to the development of institutions where students and staff feel supported, valued, and empowered to succeed (1-3). Recognizing and leveraging these leadership qualities is vital to cultivating educational spaces that promote holistic growth and development (2, 4).

One of the most significant contributions of women in educational leadership is their ability to serve as role

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models and catalysts for change. When students witness women leading with passion, intelligence, and resilience, it challenges traditional gender roles and cultivates a more inclusive mindset. This exposure inspires both male and female students to aspire to leadership roles (2-4). By breaking conventional leadership molds, women pave the way for future generations to challenge gender stereotypes and pursue their aspirations without hesitation (1-3). Their leadership demonstrates that no career aspiration is beyond reach, contributing to a more equitable future for all (2, 3).

Nevertheless, women in leadership continue to encounter numerous barriers that limit their advancement. Persistent gender biases and stereotypes shape perceptions of women's leadership capabilities. Preconceived notions that associate leadership with masculine traits create obstacles, fostering doubts about their competence and suitability for leadership roles (1- 3). The underrepresentation of women in high-level leadership positions results in a shortage of role models and mentors for aspiring female leaders, perpetuating the perception that leadership is a male-dominated domain (1-4). Many women also experience a "glass ceiling" that restricts their career progression and access to high-level decision-making roles (1-3).

Balancing work responsibilities with personal and family commitments remains a significant challenge for women in leadership roles. The demanding nature of leadership positions, long working hours, and high levels of responsibility can create conflicts between professional and personal obligations, influencing career choices and progression (1, 3). Additionally, women in educational leadership may face discrimination and harassment, manifesting as unequal treatment, exclusion from decision-making processes, and overt acts of sexism (2, 3). Insufficient institutional support, including inadequate policies, resources, and professional development opportunities, further impedes their progress (2-4). To overcome these challenges, institutions must implement inclusive leadership development programs, mentorship initiatives, and policies that support work-life balance, ensuring that women are equipped to thrive in leadership roles (3, 4).

Addressing these challenges is crucial, but it is equally important to implement practical solutions that drive systemic change. Mentorship programs have been shown to increase the number of women in leadership positions by providing guidance, support, and strategies to overcome barriers (2-5). Such programs help women navigate leadership complexities while fostering a sense of community and empowerment. Providing professional development opportunities equips women with the necessary skills and knowledge to succeed in leadership roles. Training programs should focus on leadership strategies, communication, conflict resolution, and decision-making to ensure that women are well-prepared for leadership challenges (1-4). Networking also plays a vital role in empowering women leaders by facilitating connections with other professionals, opening doors to new opportunities, and fostering collaborations. Through networking, women can find mentors and role models who offer guidance and inspiration throughout their leadership journeys (1, 3, 4). Additionally, addressing gender equity in education through policies that promote equal pay, career advancement opportunities, and inclusive decision-making processes fosters a more supportive environment for women leaders (3, 4). Such policies ensure that women are welcomed into leadership roles and supported throughout their careers (2, 4).

Recognizing and addressing women's unique challenges in educational leadership is essential for creating inclusive and equitable academic institutions (3, 5). By investing in the development and advancement of women leaders, institutions can cultivate a more diverse, inclusive, and thriving academic landscape that benefits individuals, institutions, and society as a whole (2, 4, 5). Research on women in educational leadership is critical in identifying barriers and effective strategies to overcome them, further raising awareness about the importance of gender equity in education (1, 3).

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References

1. Wang T, Gao S. Systematic review of research on women and educational leadership in Mainland China, Hong Kong and Taiwan. Educational Management Administration & Leadership. 2024 Nov;52(6):1315-33. doi:10.1177/17411432221142150.
2. Hilal YY, Mifsud D, Hammad W. Female educational leadership in the Arab world: a systematic review of published research literature. International Journal of Leadership in Education. 2024 Feb 23:1-29. doi:10.1080/13603124.2024.2316655.
3. Meza-Mejia MD, Villarreal-García MA, Ortega-Barba CF. Women and leadership in higher education: A systematic review. Soc Sci. 2023; 12(10): 555. doi:10.3390/socsci12100555.
4. Djan YB, Gordon A. Challenges of women in educational leadership position in Tano North Municipality of Ahafo Region, Ghana. Journal of Education and Practice. 2020 Nov 30;11(31):25-35.
5. Seyyedmoharrami I, Shamaeian-Razavi N, Rashidi A, Alizadeh-Ghandashi AR. The mediating role of job resilience in the relationship between humble leadership and teachers' responsibility. Work. 2025 Apr 13:10519815251324013. doi: 10.1177/10519815251324013. [PMID: 40223280]

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Original Article

Examining the Impact of Escape Room-Based Assessment on Nursing Student's Self-Efficacy Perception

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Abstract

Background: Escape rooms are a new way to teach that makes students more interested and involved. Using escape rooms in the classroom helps students understand and remember what they have learned.

Objectives: The goal of this research is to find out how an escape room-based cardiopulmonary resuscitation (CPR) test affects the self-efficacy of nursing students in their second and third semesters.

Methods: A total of 36 second and third-semester undergraduate nursing students participated in this experimental study, which used a pre-test-post-test design with a control group. Participants were randomly assigned to one of two groups: intervention (18 individuals) or control (18 individuals). Data collection tools included a demographic questionnaire, a CPR checklist, and Turner's CPR Self-Efficacy Scale, which participants completed both before and after the intervention. Participants in the intervention group split up into groups of three, each of which had a maximum of 40 minutes to unlock five locked boxes and leave the room. Descriptive statistics, the Chi-square test, independent and paired t-tests, and other statistical analyses were performed using SPSS version 16 software.

Results: Prior to the intervention, the researchers found no significant difference in the self-efficacy perception ratings of students in the escape room group (117.94±25.68) and the mannequin group (118.20±39.76) ($P > 0.05$). The independent t-test, however, revealed a statistically significant difference between the two groups' mean post-intervention self-efficacy scores ($P < 0.001$). The escape room group's mean increase over the mannequin group was 18.56, yielding an effect size of 0.6. This suggests that students who took the escape room test saw a modest increase in their judgment of their own effectiveness.

Conclusion: According to the study's results, the escape room approach may be just as successful in raising perceptions of CPR self-efficacy as the conventional mannequin-based evaluation. In the end, active learning techniques might develop into a very successful teaching strategy in nursing school. We advise carrying out more research to examine the effects of escape room design principles, learning goals, and student profiles in order to guarantee the efficacy of this approach.

Keywords: Cardiopulmonary Resuscitation; Escape Room; Nursing Students; Self-Efficacy

Background

One of the most serious medical crises is cardiac arrest (1), which continues to be one of the top causes of mortality and affects many individuals worldwide each year (2) despite the advancements in medical technology. For instance, between 350,000 and 700,000

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individuals in the European Union and 400,000 people in the US pass away from cardiac arrest outside of hospitals each year (3). The Ministry of Health reports that 300,000 individuals die from cardiac arrest each year (4). Cardiopulmonary resuscitation (CPR) is the first treatment of an individual who has had a cardiopulmonary arrest (5). Cardiopulmonary resuscitation is a life-saving technique that keeps the patient breathing and blood flowing so that the body's important systems can get the bare minimum of oxygen (6). Nurses are crucial to CPR (7) and must possess the necessary knowledge and abilities (8) since they are often the first to reach the patient's bedside during cardiac arrest (2). Nonetheless, many medical professionals are unable to provide effective CPR in authentic clinical environments (9). Less than 10% of nurses in the cardiac critical care unit are adequately trained to do cardiopulmonary resuscitation, according to the findings of an Iranian research (10). Research shows that nursing students' scientific and practical understanding of resuscitation is insufficient, despite the fact that resuscitation information and skills are taught practically from the start of nursing school (5). Three elements are often needed to save a patient from cardiac arrest: medical science, hands-on training, and proper execution. This highlights the significance of education in patient survival (11). CPR instruction is thus essential for nursing students (12). According to the conventional approach, students learn how to conduct CPR by practicing on mannequins after the teacher demonstrates the technique (13). It is advantageous to employ mannequins to educate nursing students because they enhance their communication and caregiving abilities (14), as well as solve the issues with providing high-quality CPR (15). New teaching methods have gained popularity recently to help nursing students become more proficient (8). These tactics include educational escape rooms, a brand-new group-based learning approach (16) that helps students retain and apply what they have learned in class.Escape rooms are interactive environments in which participants, frequently in small groups, must solve puzzles within a designated time frame in order to "escape" the room (17). This configuration induces a sense of urgency and exhilaration, which can substantially increase learners' motivation and engagement (18). Furthermore, escape chambers present students with the opportunity to exercise their critical and creative thinking skills. They are required to alter strategies in response to the changing context of the game, make decisions under duress, and analyze information (19). Moreover, due to their enjoyable nature, escape rooms motivate students to engage in studying (20). Escape rooms need parties to collaborate in order to escape by adhering to a narrative and resolving a sequence of problems.A major aspect in CPR instruction is self-efficacy (21). Self-efficacy is a fundamental concept in Bandura's social cognitive theory and influences how caregivers prepare to organize and execute appropriate actions during resuscitation (22). Nurses must have confidence in their capacity to provide superior care to cardiac patients (23). Roh said that nurses who have knowledge and awareness but lack self-confidence and assurance in their skills encounter difficulties in executing CPR. Research suggests that persons with sufficient knowledge and abilities in CPR may yet refrain from doing it due to poor self-efficacy; hence, educators should address this concern via effective pedagogical strategies (24). Nurses often arrive first at the patient's bedside during cardiopulmonary resuscitation and are crucial to the efficacy of resuscitation operations. Conventional pedagogical approaches often overlook the significance of elevated self-efficacy perceptions among nurses, an essential element for the effectiveness of CPR. Consequently, it is essential to investigate innovative teaching approaches, such as escape rooms, that actively involve pupils. This transition to experiential learning corresponds with the need for nurses to be well equipped for practical situations.

Objectives

The objective of the current study conducted at Zabol University of Medical Sciences was to examine the influence of escape room-based CPR assessment on the self-efficacy of nursing students in their second and third semesters.

Methods

Study Design: In order to achieve the study objectives, the researchers implemented an experimental pre-/post-test research design with a control group at the Nursing and Midwifery School of Zabol University of Medical Sciences from April to May 2024.

Participants: The incorporation of students who had not previously participated in an educational escape room or had not taken a separate CPR course outside the curriculum was the basis for evaluating the second- and third-semester undergraduate nursing students recruited in this study. The study excluded students who were not

enrolled in the practicum course, did not attend the sessions, or had incomplete grades.

Sampling: The statistical population comprised 40 fifth-semester undergraduate students. A prior study by Mohammadi et al. (25) indicated that the Mean score and Standard Deviation (SD) for the intervention (flipped classroom method) and control (face-to-face education) groups were 94.48±8.83 and 86.37 ± 5.76, respectively. It was estimated that a minimum sample size of 18 nursing students per group, with a confidence interval (CI) of 95% and a test power of 90%, was required for each group.

$$n = \frac{\left(z_{1-\alpha/2} + z_{1-\beta}\right)^2 (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2} =$$

$$\frac{(1.96 + 1.28)^2 (77.96 + 33.17)}{(94.48 - 86.37)^2} = 18$$

Intervention: The researchers conducted an orientation session for second and third-semester undergraduate nursing students to elucidate the significance of innovative teaching approaches, such as escape rooms, and their impact on learning outcomes. Subsequently, the researchers performed six-hour CPR training sessions for each semester group. Each course included four hours of lecture and two hours of mannequin exercise. The teaching material was based on the 2020 AHA CPR recommendations and underwent evaluation by three faculty members prior to implementation (26). All lessons were overseen by an educator specializing in critical care nursing. During the previous session, the researchers administered a pre-test to evaluate each student's CPR proficiency by identifying faults in their performance using a checklist. Three weeks later, they administered the self-efficacy questionnaire. Subsequently, pupils were randomly allocated to two groups by a simple random selection technique employing cards.

Course design: In order to construct this procedure, a problem-solving pattern from Maastricht University was applied. In the initial phase, a conference was conducted among three faculty members to comprehend the issue and discuss the escape room, including what needed to be communicated and clarifying points and misunderstandings about the clinical assessment. In the subsequent phase, the group members reached a consensus on the questions that needed to be addressed to elucidate the problem. The third phase featured brainstorming, when group members offered their opinions on the topic. In the fourth stage, they evaluated the data and categorized the material into three distinct groups: indicators of cardiac arrest, CPR procedures, and the use of emergency equipment. In the fifth step, they defined specific learning goals for the escape room:

Identify the signs and symptoms of the cardiac arrest.

- Demonstrate proper technique for chest compressions.
- Explain the importance of ventilation during CPR, including the ratio of compressions to breaths, and identify tracheal tube equipment.
- Explain the steps involved in using an electroshock device, including pad placement and shock delivery.
- Execute a full sequence of ACLS protocols, including rhythm analysis.
- Identify common medications used during advanced CPR, including epinephrine, vasopressin, and amiodarone.
- Explain the importance of monitoring and checking vital signs.

In the sixth step, the escape room was designed using the principles of design for simulation games noted by Koivisto et al. (2018). Using realistic and authentic patient scenarios to apply nursing knowledge in context, integrating learning objectives with game mechanics to enable students to apply clinical reasoning processes, allowing for experimentation within the game to give students alternative choices, actions, and paths (e.g., different rhythms for analysis or drug injection in the sequence of ACLS protocols), and using an online game to provide authentic graphics are some examples of these design principles (27). They considered three roles (leader, navigator, clue finder) to ensure that all team members contributed. The leader was responsible for guiding the team and making decisions; the navigator focused on keeping track of game's progress and managing time; and the clue finder searched for hints and solutions to the challenges presented in the escape room.

Flow of Escape Room

Pre-Brief: Right before the escape room game began, all students participated in a 10-minute face-to-face pre-brief session. A list of necessary materials, duties and regulations, and a rough concept of an escape room were all included in the pre-brief. After that, the students were instructed to divide into groups of three and assign each other roles according to their own choices. The participants were given an envelope with the first clue and instructed not to open it until they were inside the operating room.

Escape Room Activity: The escape room activity theme was based on Resuscitation Challenge. Students had to use their knowledge and skills in CPR to solve puzzles and riddles related to the topic, ultimately unlocking each box. They had only 40 minutes to unlock the five locked boxes and escape the room. After resuscitating the patient and opening all five crates, they were able to exit the room. A cardiopulmonary resuscitation protocol was employed by one of the researchers to evaluate the performance of each student. Each box contained resuscitation apparatus and a hint to locate the three-digit code for the subsequent box. One of the researchers was present inside the escape room to guide the students as a facilitator when they needed help solving the puzzles.

After completing escape room, participants received feedback on their performance in a 15-minute session using the PEARLS model, which consists of five stages: Setting the Scene, where a researcher creates a safe learning environment; Reactions, where a researcher reviews students' initial feelings; Description, where evaluators determine the reasons for poor performance, including struggles with equipment or uncertainty about procedures; Analysis, where researchers ask learners to identify successful interventions and those they would change, while providing feedback to address performance gaps; and Application/Summary, where the instructor summarizes lessons learned and encourages learners to identify future applications. Finally, participants completed a self-efficacy questionnaire.

Puzzles: The first puzzle involved monitoring the patient. Students had to find and connect the pieces of the puzzle, which were taped to various surfaces, including the emergency trolley, bed, and electrocardiogram device. The first box's code corresponds to the number of pulses identified in the nursing report, as indicated by the completed puzzle. The second puzzle focused on identifying tracheal tube equipment. Students located the equipment on the table, each labeled with a specific color code, and used the guide sheet from the previous box to find the correct code for the third box.

Puzzle three related to chest compressions. Students deciphered a code on the patient's wristband, which led to the question, "What is the minimum chest compression depth in mm?" This was the code for the fourth box.

The next puzzle was a crossword with questions about CPR, specifically signs and symptoms of cardiac arrest. The hidden code in the puzzle was the code for the second box.

The final conundrum concentrated on the most frequently prescribed medications for cardiopulmonary resuscitation. Students were directed to an online game where they were able to locate the code for the final capsule by scanning a QR code. The items in each compartment were arranged in the following order: Electric Shock Paddle, Patient's Electrocardiogram, Tracheal Tube, Chest Lead, and Epinephrine. The escape room follows a linear structure, but the scenario varied based on the interpretation of ECG readings. There were two types of ECG patterns that students encountered: Ventricular Tachycardia (VTAC) and Asystole.

In the third box, students found three distinct ECG strips arranged in the order of each phase of CPR. The first ECG strip represented the initial rhythm before CPR was started. The second ECG strip appeared after the first shock was delivered. The third ECG strip corresponded to the rhythm after further CPR efforts. Students needed to determine the appropriate CPR response based on the identified rhythm. Throughout the game, alternative choices were integrated into the CPR phases (Table 1).

Scenario: As medical students, you and your team are participating in a training exercise at a local hospital. Suddenly, you receive an emergency call from the cardiac care unit. A patient who was previously stable has experienced cardiac arrest. Your team has a mere ten minutes to reach the unit and revive the patient before it is too late. Upon your arrival at the unit, you discover that the door is sealed from the inside. In order to gain entry, you must solve a sequence of puzzles and mysteries. The clues are scattered throughout the room, and you must work together to find and decipher them. Once you've solved the puzzles, you can use the resuscitation equipment in those boxes to save the patient.

Room Set Up: In the skills labs, the researchers designed the escape room to resemble a room in one of the hospital wards, complete with a patient bed, monitor, glove box, etc. In total, the researchers used one escape room to assess students' CPR skills, equipping it with three simulated patients (mannequins). Other supplies in the room include a blood pressure cuff and a laryngoscope blade with a handle.

Control group: CPR test for the mannequin group was conducted individually by the same person, with specific learning goals, within a set time limit and environment. The researcher assessed each student's

performance in the skills labs, where they performed CPR on the mannequin using the CPR checklist. Then, the researchers distributed the self-efficacy questionnaire immediately after the intervention (Table 2).

Instrument

The data collecting instrument consisted of three parts: a demographic information form, a CPR checklist, and a CPR-specific self-efficacy scale devised by Turner and colleagues, which had 17 items. This scale used a 10-point visual analog scale, a self-report scale, to answer the questions. The scale ranged from 1 (the lowest) to 10 (the highest reported score). The total score ranged from 1 to 170, with scores categorized as follows: 1-56, insufficient self-efficacy; 57-112, moderately sufficient; and 113-170, sufficient. The tool's validity and reliability were previously investigated in a study by Heydarzadeh et al., which reported a Cronbach's alpha of 0.83. The demographic information form for nursing students, which was utilized to gather information such as age, gender, the most recent educational average, semester, residence status, and interest in nursing, was scientifically and content-validated by three faculty members of Zabol University of Medical Sciences. Additionally, the questionnaires' reliability was evaluated following a pilot study consisting of 10 nursing students that was administered randomly (r = 0.85). The American Heart Association's resuscitation principles were adhered to by the advanced resuscitation skills checklists, which consist of four sections: tracheal intubation (14 items), cardiac massage and artificial respiration (20 items), defibrillator use (15 items), and resuscitation management (4 items). Each accurate response was worth one point, while the incorrect response was worth zero points. The checklist's content validity coefficient was 0.89, and its Pearson correlation coefficient ranged from 0.79 to 0.91, as per Adib and Lotfi's study (28). It is important to mention that the Cronbach alpha coefficient formula (α = 0.74–0.85) was employed to assess the checklist's reliability.

Data Analysis: All statistical analyses were performed using SPSS statistical software (version 16). Kolmogorov-Smirnov test was used to evaluate the normality of variables. Based on this, the assumption of normality was confirmed for all variables. Descriptive statistics, i.e., mean ± standard deviation, percentage, and frequency, were used to describe the characteristics of the participants. Chi-square and independent t-test were used to compare qualitative and quantitative demographic data between intervention groups. Also, the paired t-test was used to examine the effect of self-efficacy perception in both groups.

Results

Initially, 36 eligible participants were chosen among 40 undergraduate nursing students utilizing the convenience sample method and inclusion criteria.

In the post-test stage, all students (100 percent response rate) completed the questionnaires and participated in the research. Participants in the escape room group had a mean age of 19.94±1.98 years, compared to 20.89±2.05 years in the mannequin group (P = 0.05). The chi-square test findings showed no significant differences between the two groups in terms of gender, residency status, or interest in nursing, showing homogeneity. Furthermore, there was no statistically significant difference in age between the study groups (P > 0.05) (Table 3).

The partial eta squared value was then computed to see how much variation in the dependent variable (mean self-efficacy perception scores) was explained by the independent variable. It has a medium to high effect size, suggesting that the independent variable has a practically substantial impact on the dependent variable. A research with this sample size is expected to have enough statistical power and a low margin of error to detect an association, hence the study was classified as significant. For further analysis, the results of the independent t-test showed that there was no significant difference among the scores of CPR-specific self-efficacy perception of students receiving the mannequin approaches (118.39±20.76), and the escape room group (117.94±25.68) before the intervention (P > 0.05). After the interventions, the escape room method increased students' CPR-specific self-efficacy perception scores (18.56±15.61) more than the mannequin approach (0.61±17.32). The independent t-test was performed based on the difference among the mean scores of the pre-test and post-test stages in intervention groups, which showed a statistically significant difference (P = 0.003). The results of the paired t-test also showed that there was no significant difference between the mean pre-test and post-test scores in the mannequin group (P = 0.88), while the escape room group showed significantly more positive changes in their self-efficacy (P < 0.001; t (35) = 5.043) (Table 4).

CPR errors were measured by counting the number of items on a standardized CPR checklist that students failed to complete properly, with each missing item representing one error.

The Wilcoxon signed-rank test revealed no significant change in the mean number of errors before and after the intervention in the mannequin group (P = 0.14). The escape room group made significantly fewer errors (P < 0.001) (Table 5).

The independent t-test revealed no statistically significant difference in mean scores before the intervention between the two groups in the variable perceived self-efficacy. Furthermore, the mean scores following the intervention in the category of perceived self-efficacy differed significantly between the two groups.

The results of Wilcoxon signed-rank test indicated that there was no significant difference between the mean number of mistakes before and after the intervention in the mannequin group (P < 0.149). In contrast, the escape room group showed a significant reduction in their number of mistakes (P < 0.001).

Discussion

This study aimed to determine the effect of escape room-based assessment on the self-efficacy perceptions of nursing students. Both groups had adequate self-efficacy perception ratings before to the evaluation, and there was no significant difference between the two groups prior to the intervention. The participants' self-efficacy perception score improved after training with a mannequin in the assessment group, but it was not statistically significant when compared to before training. In the assessment group with the escape room, the study participants' self-efficacy perception score improved following the training, which was statistically significant. Moreover, the researchers observed differences between two groups after training. The escape room group made significantly fewer mistakes during CPR.

The researchers were unable to discover any studies that investigated the influence of escape room-based evaluation on self-efficacy perceptions of CPR; so, the researchers analyzed the study's results individually with the escape room and mannequin approaches. The findings supported prior study, emphasizing the significance of self-efficacy in nursing skill training, particularly CPR. This shows that nurses should be confident in their abilities to care for cardiac patients (9). Previous research shown that self-efficacy decreases anxiety and improves nurses' ability to conduct cardiopulmonary resuscitation (8). Nursing students who practice proper cardiac massage have increased self-efficacy (29). Furthermore, Roh et al. (2014) discovered that even those with adequate knowledge and competence in CPR may fail to do it if they have poor self-efficacy. To counter this, educators must improve self-efficacy using suitable instructional methods (24). One of these methods is mannequin-based simulation. Based on Roh et al. (2011), mannequin-based simulation in nursing education increases participants' self-efficacy perception, which in turn leads to better quality CPR delivery (30).

Unlike our present investigation, simulation using a mannequin did not boost self-efficacy perceptions, which was consistent with Monjamed et al.'s findings. This research looked at the effects of two CPR teaching modalities, video and mannequin, on nursing students' knowledge and performance. Most nursing students in the mannequin and video approaches had the greatest degree of CPR knowledge, with no difference between the two teaching modalities (1). Roh's study recommended that future research explore new and diverse simulation methods, which can be used in combination with each other (30). For example, one method involves incorporating active learning methods (16).

Active learning includes a wide range of learning activities, including the flipped classroom, team-based learning, collaborative learning, games, role-playing, and so on (31, 32). Using these strategies may have a variety of good outcomes, including increased self-efficacy beliefs, improved student motivation, and increased performance and interest in relevant academic and professional pursuits (33). Jeong et al. (2019) discovered that active learning strategies enhance students' emotions and self-efficacy views. Furthermore, the research found that higher self-efficacy ratings are associated with better performance and greater satisfaction. Students with lower levels of self-efficacy, on the other hand, are more likely to dread failure (34).Thus, Andres et al. (2020) stated that active learning strategies can lead to better academic outcomes, such as higher grades and an increased likelihood of continuing education, by promoting academic self-efficacy and reducing task avoidance behaviors (35).

One of the active learning methods is using educational escape rooms. Previous studies have used escape rooms in various health science disciplines, including nursing, and referred to them as an innovative learning method or an assessment method (36). In one study, Adams et al. (2018) reported that escape room participants found it remarkably interesting and entertaining, and they suggested using game-based learning as a teaching strategy for nurses (37).

According to Molina Torres et al. (2022), escape room participants believe that this activity improves their critical thinking because they had to think about each puzzle and discuss it with one another, which improves their decision-making process, helps them remember concepts, and helps them prepare for the theory exam. In other words, this game-based strategy enhances the teaching-learning process while helping nursing students to acquire important information and build nursing skills (36). According to Bandura's self-efficacy theory, more flexible ways of learning should be adopted, resulting in increased educational engagement (38). Escape rooms are an example of a flexible and inventive strategy. Furthermore, the present study's findings revealed a substantial statistical difference in students' academic self-efficacy between the escape room group and the mannequin-based assessment technique (39). These findings suggest that the escape room format's adaptability and interactivity may be more helpful in boosting students' confidence in their academic talents and learning outcomes. However, the findings should be regarded with care owing to a number of limitations, including the unique location, small sample size, and use of convenience sampling, all of which may have an impact on the results' generalizability. To improve external validity, further study should be undertaken. Although educational escape rooms are extremely effective learning activities that may dramatically boost students' knowledge levels and satisfaction (40), Hood et al. (2021) said that although active learning improves student outcomes in STEM programs, it can also create anxiety. Students who experience social anxiety have poorer final marks (41). Among the limitations of escape rooms, based on the study by Eukel et al. (2020), are the number of rooms available, the cost of locks and escape room equipment, facilitator training, and the time required for setup, implementation, and review after completing the escape room (42).

Although setting up a physical escape room can be time-consuming and costly, virtual escape rooms offer a solution. Using Google Forms, you can create a virtual escape room without incurring any costs, although it may take some time to learn how to use the program (33).

Also, Karageorgiou et al. (2019) stated that even with guidance, not all students can complete the escape room. They cited insufficient time and motivation for not completing the escape room (43).

According to research, a few students dislike escape rooms or feel uncomfortable partaking in the experience, but usually, the feedback is good (33). Escape rooms allow students to participate in real-world circumstances in which they must use their knowledge. Collaborative problem solving in a time-limited situation is consistent with active learning theories. It improves critical thinking abilities in nursing practice (44).

Conclusion

According to the study's results, the escape room approach may be more helpful than typical mannequin-based assessments in improving CPR self-efficacy perceptions. Regardless of the findings of the statistical analysis, the mannequin evaluation provides certain benefits for improving student learning. To successfully use an escape room in nursing education settings, it is critical to first determine particular learning goals that are relevant to the curriculum. Gathering the appropriate resources and educating faculty in facilitation approaches will improve the immersive experience. Additionally, including the escape room into the curriculum via debriefing sessions will assist students in connecting principles taught to real-world nursing practice. Ultimately, active learning strategies should be considered a potential teaching method in nursing education. To ensure the effectiveness of escape rooms, it is essential to carefully evaluate the escape room design principles, learning objectives, and student characteristics.

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References

1. Shabannia A, Pirasteh A, Jouhari Z. The effectiveness of cardiopulmonary resuscitation training by mannequin training method and educational video on the awareness of Shahed University staff. Daneshvar Medicine. 2021; 29(4): 33-41. doi: 10.22070/daneshmed.2021.14976.1109. [In Persian]
2. Najafi T, Haghani H, Mollaee Z. The Effect of Smartphone-Based Learning on the Knowledge of nursing students' of adult basic cardiopulmonary resuscitation. Educ Strategy Med Sci. 2020; 12 (6):36-44. [In Persian]

3. Nishioka N, Kobayashi D, Izawa J, Irisawa T, Yamada T, Yoshiya K, et al. Association between serum lactate level during cardiopulmonary resuscitation and survival in adult out-of-hospital cardiac arrest: a multicenter cohort study. Sci Rep. 2021 Jan 15;11(1):1639. doi: 10.1038/s41598-020-80774-4. [PMID: 33452306] [PMCID: PMC7810983]
4. Norozi S, Poursiabidi P. Examining the results of cardiopulmonary resuscitation and its influencing factors with emphasis on the cause of cardiac arrest and 1-year prognosis of rescued patients. Tehran Univ Med J. 2023; 80(12): 957-64. [In Persian]
5. Aftabi M, Rahimi H, Sharifzadeh Gh HS. Quality of the cardiac massage provided by special Nurses in Birjand's hospitals, Birjand, Iran during 2019. Journal of Scientific Research in Medical Sciences. 2022;29(1):67-72. doi:10.34785/bums024.2022.008. [In Persian]
6. Sadeghi E, Bahmani H, Khorshidi S. The Status of Cardio-Pulmonary Resuscitation (CPR) and the Related Factors Thereof in Shahid Motahari Hospital of Marvdasht a Descriptive Cross-Sectional Study. Pars Journal of Medical Sciences, 2022; 18(1): 23-8. doi: 10.52547/jmj.18.1.23.
7. Ihunanya OM, Oke Michael R, Babcock B, Amere LT, Rphn B. Knowledge, attitude and practice of cardiopulmonary resuscitation among nurses in Babcock university teaching hospital in Ilishan-Remo, Ogun State, Nigeria. International Journal of Caring Sciences. 2020;13(3):1773-82.
8. Alamri AA, Baker OG. Nurses' Self-Efficacy Regarding Cardiopulmonary Resuscitation: A Literature Review. Global Journal of Health Science. 2022;14(6):1. doi:10.5539/gjhs.v14n6p1.
9. Heidarzadeh A, Jahani Y. The effect of computer simulation and mannequin on nursing students' perception of self-efficacy in cardiopulmonary resuscitation. Iran J Med Educ. 2015;14(10):876-85. [In Persian]
10. Kuchaki Z, Taheri M, Esfahani H, Erfanifam T. The effect of CPR educational package on knowledge and performance of nurses working in intensive care units: A review study. J Family Med Prim Care. 2022 May;11(5):1677-1682. doi: 10.4103/jfmpc.jfmpc_1938_21. [PMID: 35800549] [PMCID: PMC9254850]
11. Akbari Farmad S, Khoshnoodi far M, Rezaee M, Farajpour A. The effect of simulation-based cardiopulmonary resuscitation training on knowledge and clinical skills of nurses in Baharloo Hospital. Educational Development of Judishapur. 2021; 12(2): 511-20. doi: 10.22118/edc.2020.255472.1586.
12. Demirtas A, Guvenc G, Aslan Ö, Unver V, Basak T, Kaya C. Effectiveness of simulation-based cardiopulmonary resuscitation training programs on fourth-year nursing students. Australas Emerg Care. 2021 Mar;24(1):4-10. doi: 10.1016/j.auec.2020.08.005. [PMID: 32933888]
13. Buttussi F, Chittaro L, Valent F. A virtual reality methodology for cardiopulmonary resuscitation training with and without a physical mannequin. J Biomed Inform. 2020 Nov:111:103590. doi: 10.1016/j.jbi.2020.103590. [PMID: 33039589]
14. Handeland JA, Prinz A, Ekra EMR, Fossum M. The role of manikins in nursing students' learning: A systematic review and thematic metasynthesis. Nurse Educ Today. 2021 Mar:98:104661. doi: 10.1016/j.nedt.2020.104661. [PMID: 33298327]
15. Faiz M, Aimen S, Ejaz N, Abbas H, Khan M. CPR training tool for health care providers. Pakistan Journal of Science. 2023;75(02):316-22. doi:10.57041/pjs.v75i02.840.
16. Hursman A, Richter LM, Frenzel J, Nice JV, Monson E. An online escape room used to support the growth of teamwork in health professions students. J Interprof Educ Pract. 2022 Dec:29:100545. doi: 10.1016/j.xjep.2022.100545. [PMID: 35991695] [PMCID: PMC9375098]
17. Azhar F, Adnan N. Launching Cost-effective Virtual Escape Rooms as a Tool for Formative Assessment. New Emirates Medical Journal. 2024;5(1): e02506882325537. doi:10.2174/0102506882325537240612062345.
18. Rawlinson RE, Whitton N. Escape rooms as tools for learning through failure. Electronic Journal of e-Learning. 2024;22(4): 19-29. doi:10.34190/ejel.21.7.3182.
19. Veldkamp A, van de Grint L, Knippels M-CP, van Joolingen WR. Escape education: A systematic review on escape rooms in education. Educational Research Review. 2020;31:100364. doi:10.1016/j.edurev.2020.100364.
20. Sahu P, Sa B. Students and Tutors' Perspectives on the Effectiveness of Online Problem-Based Learning in Medical and Health Professions. Strides Dev Med Educ. 2025; 22(1): e1369. doi: 10.22062/sdme.2024.199708.1369.
21. Eukel H, Morrell B. Ensuring educational escape-room success: The process of designing, piloting, evaluating, redesigning, and re-evaluating educational escape rooms. Simulation & Gaming. 2021;52(1):18-23. doi:10.1177/1046878120953453.
22. Alamzadeh N, Naderifar M, Abdollahimohammad A, Firouzkouhi MR, Badakhsh M. Comparison of the effect of interactive and non-interactive education on the self-efficacy of COVID-19 patients. Healthcare in Low-resource Settings. 2023; 12(1): 1. doi:10.4081/hls.2023.11872.
23. Alaryani ZD, Alhofaian A, Elhady M. The relationship between knowledge and self-efficacy of nurses regarding early initiation of cardiopulmonary resuscitation and automated defibrillation in Saudi Arabia. Belitung Nurs J. 2021 Oct 28;7(5):387-394. doi: 10.33546/bnj.1670. [PMID: 37496508] [PMCID: PMC10367978]
24. Roh YS, Issenberg SB. Association of cardiopulmonary resuscitation psychomotor skills with knowledge and self-efficacy in nursing students. Int J Nurs Pract. 2014 Dec;20(6):674-9. doi: 10.1111/ijn.12212. [PMID: 24219782]
25. Mohammadi A, Norouzadeh R, Hosseini SE, Mohammadi M, Tahrekhani M. Investigating the Effectiveness of Online Learning in the Post-Coronavirus (COVID-19) Era from the Perspectives of Students and Faculty Members of Selected Universities of Medical Sciences in Iran. Strides Dev Med Educ. 2025; 22(1): e1447. doi: 10.22062/sdme.2025.200378.1447.
26. Merchant RM, Topjian AA, Panchal AR, Cheng A, Aziz K, Berg KM, et al. Part 1: executive summary: 2020 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2020 Oct 20;142 (16_suppl_2): S337-S357. doi: 10.1161/CIR.0000000000000918. [PMID: 33081530]
27. Koivisto J-M, Haavisto E, Niemi H, Haho P, Nylund S, Multisilta J. Design principles for simulation games for learning clinical reasoning: A design-based research approach. Nurse Educ Today. 2018 Jan:60:114-120. doi: 10.1016/j.nedt.2017.10.002. [PMID: 29096383]
28. Adib-Hajbaghery M. Longitudinally investigation of the skills of cardiopulmonary resuscitation in nurse interns of Kashan University of Medical Sciences. Iranian Journal of Cardiovascular Nursing. 2014;3(1):6-17.
29. Moon H, Hyun HS. Nursing students' knowledge, attitude, self-efficacy in blended learning of cardiopulmonary resuscitation: a randomized controlled trial. BMC Med Educ. 2019 Nov 9;19(1):414. doi: 10.1186/s12909-019-1848-8. [PMID: 31706315] [PMCID: PMC6842519]
30. Roh YS, Lee WS, Chung HS, Park YM. The effects of simulation-based resuscitation training on nurses' self-efficacy and

satisfaction. Nurse Educ Today. 2013 Feb;33(2):123-8. doi: 10.1016/j.nedt.2011.11.008. [PMID: 22153054]
31. Bucklin BA, Asdigian NL, Hawkins JL, Klein U. Making it stick: use of active learning strategies in continuing medical education. BMC Med Educ. 2021 Jan 11;21(1):44. doi: 10.1186/s12909-020-02447-0. [PMID: 33430843] [PMCID: PMC7798232]
32. Doolittle P, Wojdak K, Walters A. Defining Active Learning: A Restricted Systemic Review. Teaching and Learning Inquiry. 2023;11. doi:10.20343/teachlearninqu.11.25.
33. Aragon CJ. Determining the Effectiveness of an Escape Room in a Mental Health Nursing Course: A Quantitative Study. (Dissertations). San Diego, California: Northcentral University; 2023.
34. Jeong JS, González-Gómez D, Gallego-Picó A, Bravo JC. Effects of active learning methodologies on the students' emotions, self-efficacy beliefs and learning outcomes in a science distance learning course. JOTSE: Journal of Technology and Science Education. 2019;9(2):217-27. doi:10.3926/jotse.530.
35. Andres H. The role of active teaching, academic self-efficacy, and learning behaviors in student performance. Journal of International Education in Business. 2020;13(2):221-38. doi:10.1108/JIEB-02-2020-0017.
36. Molina-Torres G, Cardona D, Requena M, Rodriguez-Arrastia M, Roman P, Ropero-Padilla C. The impact of using an "anatomy escape room" on nursing students: A comparative study. Nurse Educ Today. 2022 Feb:109:105205. doi: 10.1016/j.nedt.2021.105205. [PMID: 34799191]
37. Adams V, Burger S, Crawford K, Setter R. Can you escape? Creating an escape room to facilitate active learning. J Nurses Prof Dev. 2018 Mar/Apr;34(2):E1-E5. doi: 10.1097/NND.0000000000000433. [PMID: 29481471]
38. Malsakpak MH, Pourteimour S. Comparison of the Effects of E-learning Blended with Collaborative Learning and Lecture-Based Teaching Approaches on Academic Self-Efficacy among Undergraduate Nursing Students: A Quasi-Experimental Study. J Adv Med Educ Prof. 2024 Apr 1;12(2):102-110. doi: 10.30476/JAMP.2024.99100.1828. [PMID: 38660430] [PMCID: PMC11036318]
39. Dittman JM, Maiden K, Matulewicz AT, Beaird G, Lockeman K, Dow A. A flexible customizable virtual escape room approach for interprofessional learners. Journal of Interprofessional Education & Practice. 2021; 24: 100455. doi:10.1016/j.xjep.2021.100455.
40. González-de la Torre H, Hernández-De Luis MN, Mies-Padilla S, Camacho-Bejarano R, Verdú-Soriano J, Rodríguez-Suárez CA. Effectiveness of "Escape Room" Educational Technology in Nurses' Education: A Systematic Review. Nurs Rep. 2024 May 13;14(2):1193-1211. doi: 10.3390/nursrep14020091. [PMID: 38804424] [PMCID: PMC11130902]
41. Hood S, Barrickman N, Djerdjian N, Farr M, Magner S, Roychowdhury H, et al. "I like and prefer to work alone": Social anxiety, academic self-efficacy, and students' perceptions of active learning. CBE Life Sci Educ. 2021 Mar;20(1):ar12. doi: 10.1187/cbe.19-12-0271. [PMID: 33600218] [PMCID: PMC8108489]
42. Morrell BL, Eukel HN. Escape the generational gap: A cardiovascular escape room for nursing education. J Nurs Educ. 2020 Feb 1;59(2):111-115. doi: 10.3928/01484834-20200122-11. [PMID: 32003853]
43. Karageorgiou Z, Mavrommati I, Fotaris P. Escape Room Design as a Game-Based Learning Process for STEAM Education. Proceedings of the 13th International Conference on Game Based Learning, ECGBL; 2019 Oct 3-4; Odense, Denmark. 2019: 378-85. doi: 10.34190/GBL.19.190.
44. Naderi far M, Rezaei Kahkhaei F, Abdollahi Nodehi MH. Escape Room, a New Method to Assess the Learning of Nursing Students: A Scoping Review. Strides Dev Med Educ. 2024; 21(1): 189-96. doi: 10.22062/sdme.2024.199892.1389.

Table 1. Content and Objectives of the Escape Room

Box	Content	Educational Objectives	Puzzle to Unlock the Box	Tasks
1	Chest Lead	Checking Vital Signs	Pieces of a puzzle were hidden inside the room. Students had to find and connect the pieces before solving the puzzle. It was also written on the puzzle that the code for the first box equals the number of pulses, which they could find using the nursing report.	Monitoring the patient
2	Tracheal Tube	Identifying Tracheal Tube Equipment	Students were tasked with detecting the tracheal tube equipment on the table, each labeled with a specific color code. Using the guide sheet from the previous box, they had to find the correct code for the third box.	Inserting a Tracheal Tube
3	Patient's Electrocardiogram (ECG)	Performing Chest Compressions Correctly	Deciphering a piece of code: Students had to decipher a piece of code on the patient's wristband. By solving it, they would come across a question that was the code for the fourth box.	ECG Interpretation
4	Electric Shock Paddle	Familiarity with the Basic Principles of Resuscitation and Diagnostic Tests	Crossword: Students had to solve a crossword puzzle with questions related to CPR, and in the end, the hidden code in the table was the code for the second box.	Using defibrillator
5	Epinephrine	Familiarity with Resuscitation Equipment and Pharmaceutical Calculations	Online Game: Students had to scan a QR code that redirected them to an online game, and by solving it, they could find the code for the last box.	Drug Injection

Table 2. PEARLS Model for Providing Feedback to Students

Stage	Activity
Setting the scene	One of the researchers will hold a feedback session for students, aiming to create a safe environment for learning.
Reactions	One of the researchers reviewed the students' initial reactions and feelings.
Description	The evaluators had to determine if the reason for the student's poor performance was apparent or not. Was the learner struggling with equipment usage or unsure about the correct procedure?
Analysis	In this step, the researchers asked the learners to identify the interventions they did well and the interventions they would change if they could redo their performance. The evaluator provided information to eliminate the student's performance gaps.
Application/summary	The instructor presented a summary of the lessons learned and asked learners to identify points they could use in the future.

Table 3. Comparison of Demographic Characteristics between the Two Intervention Groups

Variables	The mannequin group[a] (mean (SD))	The escape room group[b] (mean (SD))	P[c]
Age	20.89(2.05)	19.94(1.98)	0.17
GPA	16.82(1.49)	16.94(1.44)	0.82
	Number (Percentage)	Number (Percentage)	
Gender			0.09
Female	6(33.30%)	11(61.10%)	
Male	12(66.70%)	7(38.90%)	
Resident status			0.45
Dormitory	14(77.80%)	12(66.70%)	
Home	4(22.20%)	6(33.30%)	
Semester			1.00
Two	8(44.40%)	10(55.60%)	
Three	10(55.60%)	8(44.40%)	
Interesting to the nursing filed			0.29
Yes	10(55.60%)	13(72.20%)	
No	8(44.40%)	5(27.80%)	

a) The mannequin-based methods group; b) The escape room methods group; c) The independent t-test was used to compare the groups; statistically significant at P-values<0.05; d) Chi-square test was used to assess the difference in the distribution of a categorical variable between two independent groups.
SD: Standard deviation

Table 4. Comparison of the Mean Score of the perceived Self-Efficacy Score in the Intervention Groups

Group	Before intervention (mean (SD))	After intervention (mean (SD))	Mean Difference (95% CI)	Paired t-test (P-value)
Mannequin group	118.39(20.76)	119.00(26.306)	0.61 (-9.23, 8.00)	0.88
Escape room group	117.94(25.68)	136.50(24.71)	18.56 (10.79, 26.32)	< 0.001

SD: Standard deviation; CI: Confidence interval

Table 5. Comparison of mean number of mistakes in the two control and intervention groups

Mistakes	Before intervention (mean (SD))	After intervention (mean (SD))	P
The mannequin group[a]	5.12(4.95)	4.87(4.99)	0.140
The escape room group[b]	5.29(4.76)	3.83(4.25)	< 0.001

SD: Standard deviation

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Review Article

Innovative E-Learning Methods in Health Sciences Education, Future Directions After COVID-19 Pandemic: A Systematic Review

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Abstract

Background: Universities were compelled to transition from in-person instruction to online instruction following the COVID-19 pandemic. Nevertheless, this transition has presented a plethora of obstacles, necessitating the development of innovative solutions to guarantee that all students have access to effective and inclusive learning experiences.

Objectives: We conducted a review investigating the innovative E-learning methods in health sciences education.

Methods: This study was designed as systematic review. We searched PubMed, Scopus, Eric, Google Scholar, and Iran Scientific Database from start of the pandemic to September 2021. Papers meeting our inclusion criteria were reviewed for data extraction. Screening of articles, data extraction, and risk of bias assessment was done in double-blind groups. Our primary objective was to provide a comprehensive overview of emerging e-learning methods and to assess their effectiveness using eleven commonly used metrics that are used to quantify the efficacy of online learning. As a secondary outcome, we employed Kirkpatrick's four levels of learning to assess the quality of online learning.

Results: Six Thousand Four Hundred Ninety Two papers were identified, thirty records were included, the majority of studies reported (n= 25) a transition of previous methods to online formats. Five studies described innovative methods. The included studies were classified as moderate to high risk of bias. In the study of success factors, the most ignored area was 'usage of suitable assignments' (37.5%), while 'optimal quality of media' emerged as the most consistently used component (67%). All studies assessed Kirkpatrick's level 1, 76% had assessed level 2. None described Kirkpatrick levels 3 or 4.

Conclusion: E-learning can be alternatively utilized for health education. Future E-learning research should incorporate randomized designs and adhere to principles of Kirkpatrick model, with a particular focus on levels 3 and 4, to develop more effective evidence-based systems.

Keywords: E-learning; Online Learning; Health Education; Systematic Review

Background

COVID-19 pandemic has emerged as a substantial global hazard, resulting in a substantial number of disruptions, including the closure of educational institutions. Despite the numerous obstacles associated with this precipitous transition, educational institutions were compelled to rapidly transition from traditional learning methods to e-learning (electronic learning) platforms in order to mitigate the virus's spread (1, 2). Although the pandemic's effects are felt in all nations, it was anticipated that underdeveloped nations would be more severely impacted because of their lack of proper

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infrastructure, technology, and medical facilities (3). Notably, China, Europe, Iran, South Korea, and the United States are among the countries that were first severely affected by significant epidemics (4, 5). The provision and use of online learning materials during COVID-19 pandemic become a central challenge for many universities (1). E-learning profoundly affected the education sector, transforming the entire system and emerging as a significant topic of interest among academics (2). In response to universities shutting down the role of Information and communication technologies (ICTs) became more prominent. ICTs provide unique opportunities for educational advancement, offering potential improvements in teaching, learning, and fostering innovation and creativity for E-learning (3). Another definition stresses E-learning as the systematic delivery, organization, and administration of online learning activities such as student enrollment, tests, assignments, course descriptions, and lesson plans (6). E-learning systems became a crucial source of information in terms of their accessibility (available anytime and anywhere), affordability, user-friendliness, and interactive nature (1). For the individuals living far from universities, E-learning offers the advantage of saving time and effort, making it a preferred option for many scholars (4). Moreover, many users of E-learning platforms believe that online learning simplifies course management, making it easier for learners to access both teachers and teaching materials (5).

Nonetheless, a notable disadvantage of E-learning is the deficiency of interaction, both between students and instructors and among peers (7). Furthermore, issues such as inadequate internet access, low ICT proficiency, and insufficient content creation have posed significant hurdles for universities, particularly in developing countries. This study aimed to provide a summary of education via E-learning after COVID-19, focusing on the recently adopted methods, comparing and assessing their quality using two different measures: first, the eleven commonly used success factors of E-learning, and second, Kirkpatrick's four levels of learning.

Objectives

We conducted a review investigating the innovative E-learning methods in health sciences education.

Methods

Study design: This study was designed as a systematic review to summarize the innovations and quality of post-COVID-19 E-learning in health education. The ethical committee of Hormozgan University of Medical Sciences has registered and endorsed our proposal (IR.HUMS.REC.1401.070). The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline was implemented (8). We used distinct stages, designing PICO, identifying inclusion and exclusion criteria, developing search strategies, screening, developing standardized pilot data extraction forms, extracting articles data, quality assessments, coding data, and summarizing the results (9).

Searching databases: A comprehensive search was conducted in PubMed, Scopus, Eric, Google Scholar, and the Iranian Scientific Information Database. We searched the databases using a mix of keywords, concentrating on the important ones, such as E-learning; "Distance learning" or "E-learning", Health sciences education; "Medical education" or "Nursing education", COVID-19; "SARS-CoV-2" or "Corona virus". Table A1 in Appendix 1 shows PubMed search query. We limited our search period to after the beginning of pandemic in terms of the heterogeneity of pre-pandemic studies and we aimed to assess and compare recent methods in the new era of health education. The search was performed in April 2020 and was updated in September 2021. Search results were recorded and deduplicated using EndNoteX7.

Eligibility criteria and study selection: Inclusion Criteria: 1; controlled and uncontrolled interventional studies, including randomized controlled trail (RCT), non-randomized controlled trial (NRCT), and before-after design. 2; studies with educational intervention for E-learning or virtual learning during physical distancing. 3; Sampling from health sciences students.

Exclusion criteria: We didn't include the studies if the sampling was from medical residency programs or if the study type was observational, case report, case series, review, editorial, or commentary. However, editorial or commentary studies with original data were included.

The title, abstract, and full-text articles of potentially eligible studies were evaluated by pairs of independent reviewers in accordance with the inclusion and exclusion criteria (Figure 1). As a selection criterion for potentially eligible studies, we implemented the PICOTS system (10) (Figure A1 in Appendix 1).

Data extraction: A standardized pilot data extraction form was designed by a medical education specialist. Data extraction of full-text was performed in teams of paired reviews.

All conflicts were resolved by the consensus or verdict of a third reviewer when necessary.

Risk of bias assessment: To evaluate the risk of bias in uncontrolled interventional studies, we employed a questionnaire comprising five items: Adequate sample size, clearly defined study population (inclusion and exclusion criteria), methods for controlling confounding factors, appropriate statistical analyses including parametric and non-parametric tests (e.g., t-test and chi-squared test), and explicit methods for measuring exposure and outcomes. In the case of interventional studies, most of them were conducted as pre-post-trial designs or interventions without a control group, leading to a potentially high risk of bias. For randomized controlled trials, we used the Cochrane ROB 2.0 assessment tool (11) (Figure A2 in Appendix 1 for the complete description).

Data synthesis: The primary authors conducted data synthesis and engaged in discussions with the research team and medical education specialist (F.K.). It was not possible to conduct a meta-analysis due to the significant variation in instructional design, clinical, population, comparator, and methodological aspects among the identified studies. As a result, this review's conclusions are summarized in a narrative report.

Outcomes: Our primary outcome was to summarize new E-learning methods, and assess their success factors. To compare and assess the methods and models of E-learning and unify their diversity reported in the included studies, we used 11 items based on homologous qualities in articles using different (7-15). These items were as follows, 1. Optimal Quality of Media Factors 2. Appropriate Evaluation Strategies 3. Provide an appropriate assignment 4. Useful, Relevant and Up-to-date content 5. Optimal Interaction 6. Student Satisfaction 7. Educator competence 8. System training and clear instructions for using E-learning Components 9. Constructive answers and feedback to students 10. Availability 11. Ease of use (Technical difficulties). Find the detailed description of each mode in Table A3 in Appendix 1.

Our secondary outcome was to check the levels of learning for this purpose we used the Kirkpatrick evaluation model. The model is composed of four levels, with the upper levels demonstrating a more profound level of learning. The immediate reaction and satisfaction of students are measured at level 1, while learning and skill development are assessed through exams at level 2. Behavior changes in real-world tasks are typically assessed through observations at level 3, and productivity and business metrics are employed to evaluate results at level 4.

Results

Study selection: The first search uncovered 6492 papers in electronic databases. 3506 title abstracts were examined after eliminating duplicates. Of the 81 papers selected for full-text screening, 30 met the inclusion requirements. The PRISMA flowchart is shown in Figure 1. Of the sixteen investigations, one was an RCT; thirteen were NRCTs; and sixteen were uncontrolled interventional before-after studies. Table A2 in Appendix 1 lists the typical results of the thirty articles examined.

Risk of bias in studies: Among 30 articles, 6 articles had a high risk of bias. To reduce the potential chances of bias, we didn't include the high risk of bias group in evaluating E-learning success factors in articles. The quality of the remaining 24 articles was mostly rated as moderate, with a mean score of 10.92. Out of a total of 16, the studies' risk of bias score varied from 7 to 15 points (The visualized risk of bias assessment is attached in Figure A2 in Appendix 1). Of the examined studies, only one was constructed as RCT, Suppan (12), which evaluated the risk of bias as rather troubling.

Geographic origin of studies: The included studies' geographic spread is as follows: Of the eleven investigations (37%), seven were conducted in North America, four (13%) in Eastern Asia, three (10%) in Western Asia, and seven (23%) in Europe. Most of the articles' geographical range includes affluent regions (Figure A3 in appendix 1).

Characteristic of participants: There were 22,373 total competitors. Each research included between 16 and 19050 students. Seventeen percent of five studies did not provide the participant count. Undergraduate students participated in all studies. Of the 21,801 people counted, 97% were medical students, according to 21 research. Of the two studies, 252 nursing students participated. Table A2 in Appendix 1, contains the baseline information of included studies, and Figure A4 in Appendix 1 shows the prevalence of each educational field.

The studies covered a variety of content areas and medical specialties, including, five studies (17%) focused on the basic science (e.g. anatomy and pathology), one (3%) on medical ethics, and two (7%) on clinical skills (e.g. communication skills and physical exam skills). In two studies (3%), virtual training was conducted for all medical lectures during pandemic (Table A2 in

Appendix 1). Eleven studies (57%) utilized online platforms to deliver content, while three studies (9%) employed offline methods. Furthermore, eleven studies (34%) used a combination of both online and offline content (Figure A5 in Appendix 1)

Educational methods and innovations: Among online education methods described in the studies, most adapted traditional face-to-face approaches into online or offline formats using various platforms or applications. However, some studies introduced innovative educational strategies developed in response to the pandemic. For instance, Suppan et al. evaluated the impact of a gamified E-learning module on the adequacy of personal protective equipment (PPE) for paramedic students, Similarly, Kang et al. investigated the learning effects of Virtual Reality Simulation (V-Sim) on nursing students caring for children with asthma (13). Table 1 shows the explanation of different methods applied in each study, and Figure A6 in Appendix 1 shows the prevalence of each method. The most widely used platform was Zoom (34%). We outlined the features of platform to assist in selecting the appropriate educational methods (Table 1 and Table A4 in Appendix 1).

Evaluation of the success factors of E-learning: In the studies that were included, we evaluated the presence of eleven success factors that are frequently employed in online education (Figure 2). 'Optimal quality of E-learning system and utilization of desirable media factors' was reported in nearly 80% of the studies, making it the most prevalent factor. Furthermore, "System training and clear instructions for using E-learning" were incorporated into 42% of the studies. Furthermore, 37.5% of the studies provided 'Appropriate assignments', while an equal percentage did not include this factor, indicating it was the least reported.

Sixty-seven percent of studies incorporated 'Optimal evaluation strategies and their relevance to the content'. Various examination methods used to assess students are detailed in Table 1.

We compared the included articles based on the eleven online education success factors identified in this study. In general, our results indicate that Michener's study (9) achieved the highest educational quality.

Kirkpatrick's levels of evaluation in studies: All of the evaluations' report findings were consistent with levels 1 (reaction/satisfaction) and 2 (learning, based on self-report, quizzes) (N=24). No study had provided information about level 3 (behavior) or level 4 (result) of Kirkpatrick's pyramid (Table 1 and Figure 3).

To assess participant reactions, various methods were employed across studies. Most studies used surveys with a 4- or 5-point Likert scale, along with pre- and post-class multiple-choice questions (MCQs), and post-class quizzes. Other methods were as follows (13); confidence in practice tool developed by Kim (15), Student Evaluation of Educational Quality (SEEQ) survey, which used a five-point Likert scale (16), interactive patient case management using EvaSys software, open-book exam, Canvas discussion board to gather real-time feedback throughout the course, and objective structured clinical examination (OSCE) stations (Table 1).

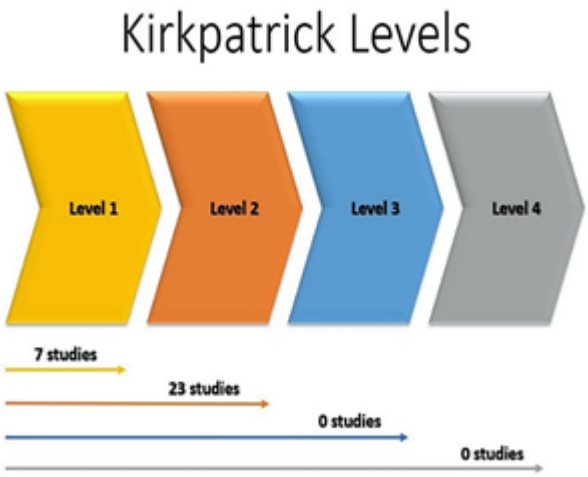

Figure 3. Kirkpatrick's assessment of peer-reviewed articles

Discussion

We identified 30 studies on electronic educational interventions in this systematic review. In the aftermath of the COVID-19 pandemic, online education has emerged as a prospective new method that is highly regarded by medical education experts. Our objective was to offer a summary and comparison of innovative E-learning methods that were supported by evidence in order to resolve the voids and provide guidance for the future.

Educational methods and innovations: "Live didactic" and "case-based activities" were the most commonly used methods, along with group activities and problem-based learning sessions. Lectures were shared online and offline, with synchronous E-learning preferred over asynchronous methods to provide better control and motivation for students. The transition to 'new normal' brings challenges such as video-conferencing fatigue, suboptimal social interaction, and a high educational load for faculty (17). Virtual

stimulation has been used as an innovative teaching method, and AMEE 2024 has also highlighted the impact of virtual stimulation as an emerging teaching method (18). Artificial intelligence is increasingly transforming education by enabling personalized, adaptive learning experiences and streamlining content creation. These advancements offer real-time feedback and efficient, self-directed learning. However, challenges persist, including data privacy concerns, algorithmic bias, unequal access to technology, and the absence of comprehensive legal frameworks. Addressing these issues is crucial to ensure that AI contributes positively to the future of education (19).

Evaluation of the success factors of E-learning: The primary purpose of this research was to delineate effective ways of E-learning. To do this, we created a quality assessment sheet grounded on many success elements of E-learning. Ehlers et al. have classified the success variables into seven frameworks: institutional, technical, instructional design, pedagogical, student support, faculty support, and evaluation (20). The provision of educational assistance is crucial for the success of E-learning (21). The dominant trend seems to be moving from text to graphics or video and using 'richer' media in the design (22). Assignments had the least attention paid among reviewed papers. Based on Alqahtani et al., students should comprehend their responsibility during social distancing, develop distinct attitudes, and discover self-motivation for academic achievement (21). Although many factors for effective E-learning were identified, there is still a lack of standardized and high-quality questionnaires for assessing E-learning quality. Having a reference tool for E-learning quality assessment would help universities and lecturers identify and address deficiencies. Sinclair et al. found that the differences in intervention design and evaluation methods prevented generalizable conclusions about the effectiveness of E-learning on health worker behavior (23). High-income countries had produced the highest number of articles, which may potentially bias the rating quality of E-learning outcomes. Inadequate infrastructure, such as bandwidth limitations makes it hard to implement E-learning properly in LMICs (24). Despite the many advantages of E-learning, ongoing limitations prevent it from reaching its full potential in LMICs (9).

Assessment of learning: The assessment of participants in E-learning environments has undergone significant transformation in the pandemic. These methods should assess students' knowledge, but also evaluate their engagement, satisfaction, and overall learning outcomes in this new educational paradigm. One of the most widely used assessment methods in post-pandemic E-learning is the survey, particularly those utilizing 4- or 5-point Likert scales. Likert scales assist instructors in statistically evaluating students' feedback on course components such as organization, clarity, and delivery (25). Open book examinations were used in some research, since OBE improves the learning environment and often supplants surface learning with deep learning (26). However, recent studies conducted during the pandemic indicated that the average scores achieved by students in an Outcome-Based Education (OBE) framework are much greater than those obtained in a closed-book assessment (26, 27). Throughout the epidemic, online platforms emerged as viable substitutes for content delivery and learning evaluations. Learning Management Systems (LMS), such as Moodle and Canvas, enhance course delivery and evaluations, allowing instructors to design quizzes and monitor student progress (28).

The shift to online assessments ensured continuity in education and offered flexibility. However, the challenges included technical issues, on the faculty side, the primary issue is insufficient training in online assessment methods (29), while on the students' side, there are concerns about dishonesty and misconduct. On the other note, the compulsory establishment of online learning infra-structure improved the quality of education post-COVID-19 era in the universities (30).

Kirkpatrick model: In most articles, interventions were evaluated based on the first and second levels of Kirkpatrick's pyramid (reaction and/or learning). However, the third and fourth levels were not measured in any of the articles. The rapid transition to E-learning, along with its inherent limitations, posed significant obstacles (31). Levels 3 and 4 are crucial as they help organizations target job-critical skills, though their value is sometimes questioned. Kirkpatrick et al. noted that no final results from a training program can be expected unless positive behavior change occurs (32). Kirkpatrick et al. noted that no final results from a training program can be expected unless positive behavior change occurs (32). A qualitative study by Badri et al. revealed that the crisis caused by the COVID-19 pandemic significantly impacted the ability of new general physicians to achieve the desired competence, as many completed parts of their clinical training during that period (29). Therefore, more emphasis needs to be placed on the quality of

operations, teaching content, and pedagogic and technical support services for E-learning.

Risk of bias: We utilized a checklist of seven elements to evaluate the quality of all non-RCT studies. Six items were considered high risk. The majority of the remaining articles exhibited a moderate risk of bias. Fatani et al. (16) demonstrated the lowest risk of bias (12). Time and resource restrictions caused by the epidemic have compounded the situation (17). The one RCT trial included was evaluated using the Cochrane ROB2 technique and had moderate quality of evidence. There is a scarcity of high-quality RCTs in education research. This absence of evidence makes it difficult for decision-makers to make sound judgments.

Limitations: Our scoping review is primarily descriptive, focusing on English and Persian studies. It's possible that it left out important insights from other languages. The review was limited to a specific time period, so it may not fully reflect the changing landscape of E-learning in health sciences education. Using gray literature can provide useful information. However, our review did not include these sources. The studies we included showed considerable heterogeneity in terms of methodologies and contexts. Consequently, conducting a meta-analysis was not feasible. We strongly recommend designing and proposing consistent quantitative and standardized assessment models for online education to support meta-analysis and precise decision making.

Conclusion

Our findings indicate that E-learning can be a potential alternative method for face-to-face learning and several factors can be modified to enhance learning. We suggest designing a comprehensive framework to address the unique aspects of E-learning**.** Future E-learning research should use more randomized trial design and place a greater emphasis on levels 3 and 4 of Kirkpatric model to develop more effective, evidence-based systems.

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References

1. Maatuk AM, Elberkawi EK, Aljawarneh S, Rashaideh H, Alharbi H. The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. J Comput High Educ. 2022;34(1):21-38. doi: 10.1007/s12528-021-09274-2. [PMID: 33967563] [PMCID: PMC8091987]
2. Bacher-Hicks A, Goodman J, Mulhern C. Inequality in household adaptation to schooling shocks: Covid-induced online learning engagement in real time. J Public Econ. 2021 Jan:193:104345. doi: 10.1016/j.jpubeco.2020.104345. [PMID: 34629567] [PMCID: PMC8486492]
3. Blundell R, Costa Dias M, Joyce R, Xu X. COVID-19 and Inequalities. Fisc Stud. 2020 Jun;41(2):291-319. doi: 10.1111/1475-5890.12232. [PMID: 32836542] [PMCID: PMC7362053]
4. Sahu P. Closure of universities due to coronavirus disease 2019 (COVID-19): impact on education and mental health of students and academic staff. Cureus. 2020 Apr 4;12(4):e7541. doi: 10.7759/cureus.7541. [PMID: 32377489] [PMCID: PMC7198094]
5. Mseleku Z. A literature review of E-learning and E-teaching in the era of Covid-19 pandemic. California, USA: Sage; 2020.
6. Haghshenas M. A Model for Utilizing Social Softwares in Learning Management System of E-Learning. Quarterly of Iranian Distance Education Journal. 2019; 1(4): 25-38. doi: 10.30473/idej.2019.6124.
7. Somayeh M, Dehghani M, Mozaffari F, Ghasemnegad SM, Hakimi H, Samaneh B. The effectiveness of E-learning in learning: A review of the literature. International Journal of Medical Research & Health Sciences. 2016;5(2):86-91.
8. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Rev Esp Cardiol (Engl Ed). 2021 Sep;74(9):790-799. doi: 10.1016/j.rec.2021.07.010. [PMID: 34446261]
9. Barteit S, Guzek D, Jahn A, Bärnighausen T, Jorge MM, Neuhann F. Evaluation of e-learning for medical education in low-and middle-income countries: A systematic review. Comput Educ. 2020 Feb:145:103726. doi: 10.1016/j.compedu.2019.103726. [PMID: 32565611] [PMCID: PMC7291921]
10. Clephas PRD, Hoeks SE, Trivella M, Guay CS, Singh PM, Klimek M, et al. Prognostic factors for chronic post-surgical pain after lung or pleural surgery: a protocol for a systematic review and meta-analysis. BMJ Open. 2021 Jun 15;11(6):e051554. doi: 10.1136/bmjopen-2021-051554. [PMID: 34130966] [PMCID: PMC8207993]
11. Eldridge S, Campbell M, Campbell M, Dahota A, Giraudeau B, Higgins J, et al. Revised Cochrane risk of bias tool for randomized trials (RoB 2.0): additional considerations for cluster-randomized trials. Cochrane Methods Cochrane Database Syst Rev. 2016;10(suppl 1): 1-17.
12. Suppan L, Stuby L, Gartner B, Larribau R, Iten A, Abbas M, et al. Impact of an e-learning module on personal protective equipment knowledge in student paramedics: a randomized controlled trial. Antimicrob Resist Infect Control. 2020 Nov 10;9(1):185. doi: 10.1186/s13756-020-00849-9.
13. Kang K-A, Kim S-J, Lee M-N, Kim M, Kim S. Comparison of learning effects of virtual reality simulation on nursing students caring for children with asthma. Int J Environ Res Public Health. 2020 Nov 13;17(22):8417. doi: 10.3390/ijerph17228417. [PMID: 33202996] [PMCID: PMC7696217]

14. Michener A, Fessler E, Gonzalez M, Miller RK. The 5 M's and More: A New Geriatric Medical Student Virtual Curriculum During the COVID-19 Pandemic. J Am Geriatr Soc. 2020 Nov;68(11):E61-E63. doi: 10.1111/jgs.16855. [PMID: 32955724] [PMCID: PMC7537043]
15. Kim YH, Jang KS. Effect of a simulation-based education on cardio-pulmonary emergency care knowledge, clinical performance ability and problem solving process in new nurses. J Korean Acad Nurs. 2011 Apr;41(2):245-55. doi: 10.4040/jkan.2011.41.2.245. [PMID: 21551996]
16. Fatani TH. Student satisfaction with videoconferencing teaching quality during the COVID-19 pandemic. BMC Med Educ. 2020 Oct 31;20(1):396. doi: 10.1186/s12909-020-02310-2. [PMID: 33129295] [PMCID: PMC7602774]
17. Stojan J, Haas M, Thammasitboon S, Lander L, Evans S, Pawlik C, et al. Online learning developments in undergraduate medical education in response to the COVID-19 pandemic: A BEME systematic review: BEME Guide No. 69. Med Teach. 2022 Feb;44(2):109-29. doi: 10.1080/0142159X.2021.1992373. [PMID: 34709949]
18. Keshavarzi MH, Hashemi A, Norouzi A, Ramezani G. Twelve Tips to Improve the Quality of Medical Education, the Experience of AMEE Live 2024 Conference. Strides Dev Med Educ. 2025;22(1): e1471. doi: 10.22062/sdme.2025.200537.1471.
19. Keshavarzi MH, Ramezani G, Shafian S. Challenges and Opportunities of Artificial Intelligence (AI) in Teaching-Learning Process. Strides Dev Med Educ. 2025;22(1): e1457. doi: 10.22062/sdme.2024.200449.1457.
20. 20. Ehlers U-D. Quality in e-learning from a learner's perspective. European Journal of Open, Distance and E-learning. 2004;7(1): 1-7.
21. Alqahtani AY, Rajkhan AA. E-learning critical success factors during the covid-19 pandemic: A comprehensive analysis of e-learning managerial perspectives. Education sciences. 2020;10(9):216. doi:10.3390/educsci10090216.
22. Masoumi D, Lindström B. Quality in e-learning: a framework for promoting and assuring quality in virtual institutions. Journal of Computer Assisted Learning. 2012;28(1):27-41. doi:10.1111/j.1365-2729.2011.00440.x.
23. Sinclair PM, Kable A, Levett-Jones T, Booth D. The effectiveness of Internet-based e-learning on clinician behaviour and patient outcomes: a systematic review. Int J Nurs Stud. 2016 May:57: 70-81. doi: 10.1016/j.ijnurstu.2016.01.011. [PMID: 27045566]
24. Frehywot S, Vovides Y, Talib Z, Mikhail N, Ross H, Wohltjen H, et al. E-learning in medical education in resource constrained low-and middle-income countries. Hum Resour Health. 2013 Feb 4:11:4. doi: 10.1186/1478-4491-11-4. [PMID: 23379467] [PMCID: PMC3584907]
25. Dawson K. Teacher inquiry: A vehicle to merge prospective teachers' experience and reflection during curriculum-based, technology-enhanced field experiences. Journal of Research on Technology in Education. 2006;38(3):265-92. doi:10.1080/15391523.2006.10782460.
26. Ashri D, Sahoo BP. Open book examination and higher education during COVID-19: Case of University of Delhi. Journal of Educational Technology Systems. 2021;50(1):73-86. doi:10.1177/0047239521013783.
27. Eurboonyanun C, Wittayapairoch J, Aphinives P, Petrusa E, Gee DW, Phitayakorn R. Adaptation to open-book online examination during the COVID-19 pandemic. J Surg Educ. 2021 May-Jun;78(3):737-739. doi: 10.1016/j.jsurg.2020.08.046. [PMID: 33011103] [PMCID: PMC7467022]
28. Pardim VI, Contreras Pinochet LH, Viana ABN, Souza CAd. Where is the student who was here? Gamification as a strategy to engage students. The International Journal of Information and Learning Technology. 2023;40(2):177-92. doi:10.1108/IJILT-05-2022-0122.
29. Badri B, Azemian A, Mokhtari Zanjani M, Shafian S, Yazdankhafard M. How Did the COVID-19 Pandemic Affect the Clinical Skills and Competencies Among New General Physicians: A Qualitative Study. Strides Dev Med Educ. 2025;22(1): e1462. doi: 10.22062/sdme.2025.200457.1462.
30. Mohammadi A, Norouzadeh R, Hosseini SE, Mohammadi M, Tahrekhani M. Investigating the Effectiveness of Online Learning in the Post-Coronavirus (COVID-19) Era from the Perspectives of Students and Faculty Members of Selected Universities of Medical Sciences in Iran. Strides Dev Med Educ. 2025;22(1): e1447. doi: 10.22062/sdme.2025.200378.1447.
31. Krawiec C, Myers A. Remote assessment of video-recorded oral presentations centered on a virtual case-based module: a COVID-19 feasibility study. Cureus. 2020 Jun 20;12(6):e8726. doi: 10.7759/cureus.8726. [PMID: 32699721] [PMCID: PMC7372193]
32. Kirkpatrick DL. Another look at evaluating training programs: Fifty articles from training & development and technical training: Magazines cover the essentials of evaluation and return-on-investment. Alexandria, VA: American Society for Training & Development; 1998.

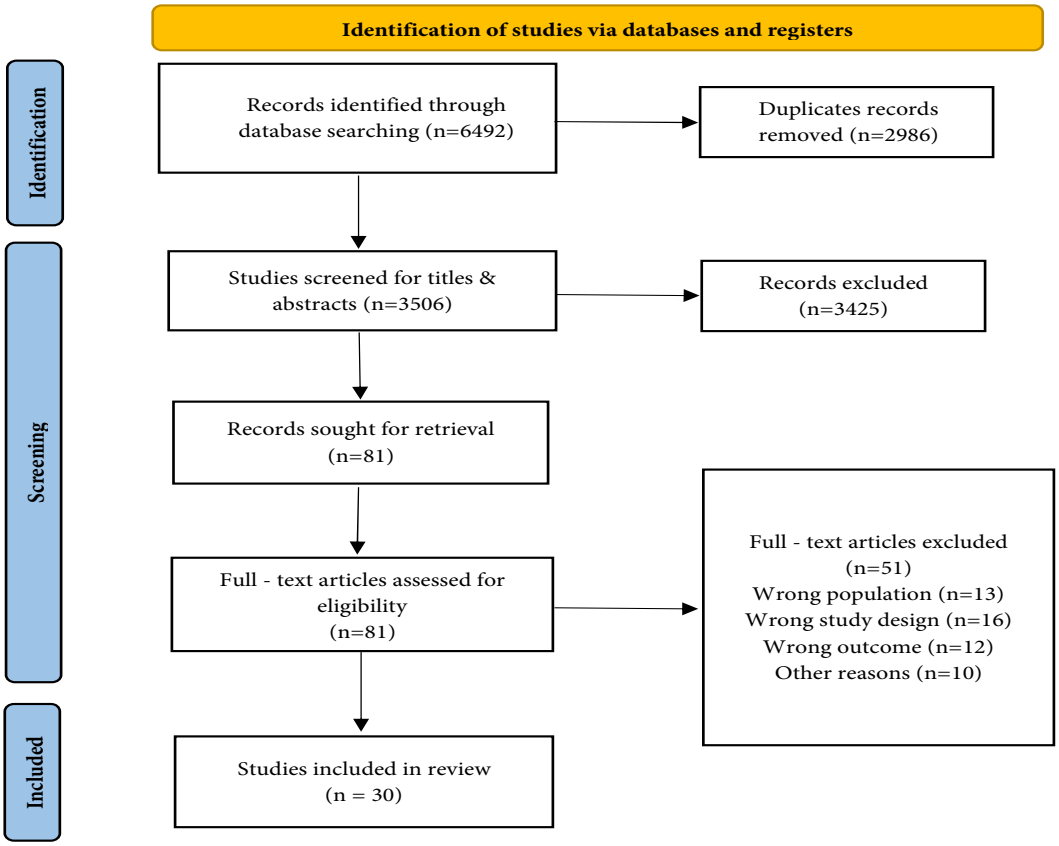

Figure 1. PRISMA flow diagram

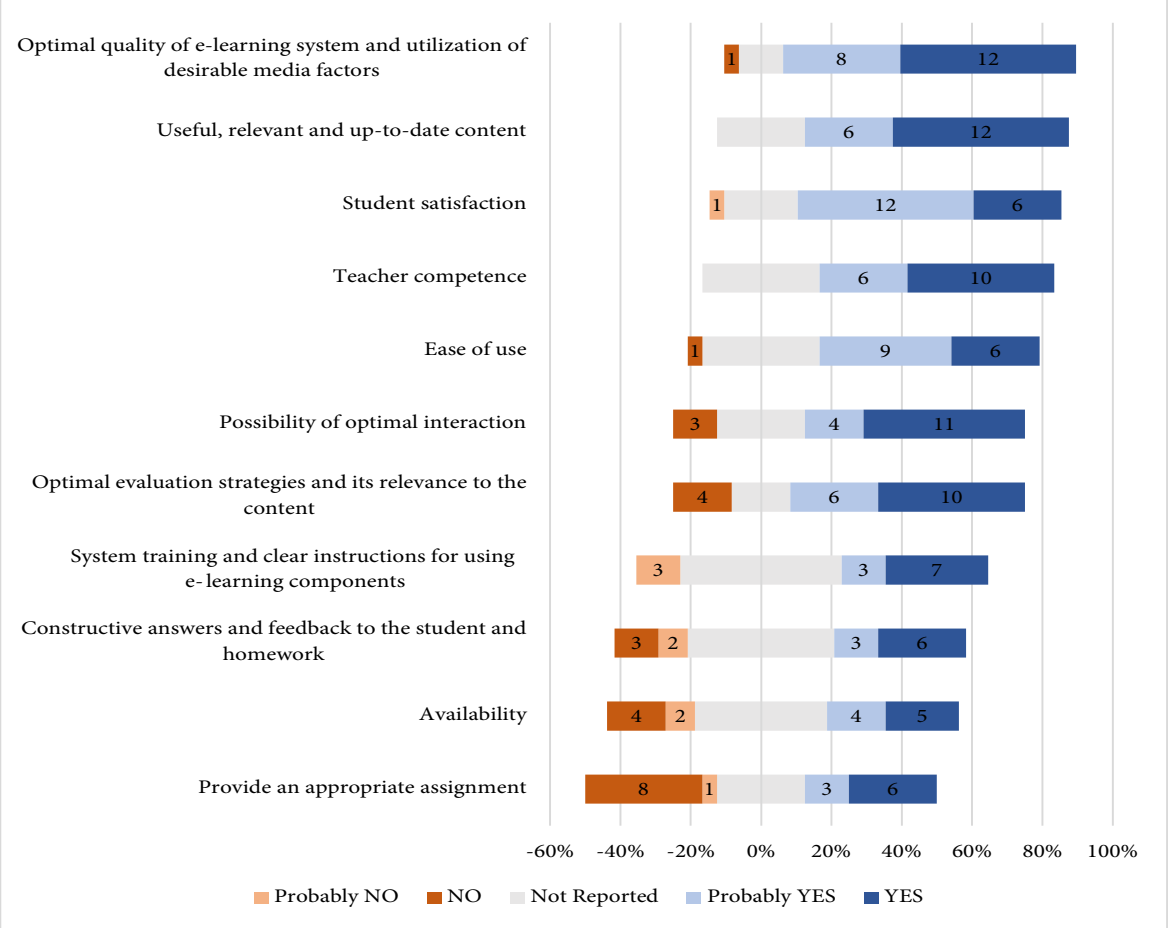

Figure 2. Factors affecting the quality of E-learning

Table 1. Summary of interventions utilized, application or platforms used, description of performed examination (level two of Kirkpatrick), and Kirkpatrick's outcomes

Reference	Country	Major	Intervention Explanation	Platforms	Level 2 Kirkpatrick assessment	Kirkpatrick level
Alkhowailed-2020	Saudi Arabia	Medicine	Online PBL sessions, Team-Based Learning, Seminar and assignments.	Blackboard, Zoom, WhatsApp	Digital exams are composed of clinical scenario-based multiple-choice questions.	2
Bhandari-2021	India	Medicine	Virtual classes with video conferencing.	Cisco WebEx, Google Forms, WhatsApp groups	-	2
De Ponti-2020	Italy	Medicine	Simulated patient-centered situations inside the "Body Interact™" platform. Supplementary online training included formal presentations and discussions of clinical examples.	Body Interact	-	1
Eusuf-2020	UK	Anesthesia trainee	Combination of prerecorded and live online tutorials.	Zoom, Vimeo	Pre- and post-MCQ	2
Fatani-2020	Saudi Arabia	Medicine	Video conferencing, and case-based discussions that enable real-time, two-way video and audio communication between instructors and students.	Blackboard, Zoom	SEEQ survey with a five-point Likert scale.	2
Gomez-2020	USA	Medicine	Several interactive workshops, Prerecorded Lectures, and Remote Didactics via Zoom	Blackboard, Zoom, Microsoft Teams	Open book and was offered online via the course Blackboard site.	2
Gulati-2020	UK	Medicine	Instagram posts daily multiple-choice questions as "Instagram Stories." MCQs addressed a variety of subjects that were pertinent to the clinical generalist orientation of the society. Following a brief clinical scenario, each multiple-choice question (MCQ) featured four answer options that were determined through the exam function, as well as an explanation of the selected option.	Instagram	An online survey circulated through Instagram.	2
Henderson-2020	UK	Medicine, Nursing	Distance teaching sessions via Microsoft Teams	Microsoft Teams	-	2
Krawiec-2020	USA	Medicine	A feasibility study demanding that students videotape an oral presentation assignment. Focused on a virtual case-based module for formative assessment.	Canvas	The patient presentation tool employs behavioral and verbal anchors to evaluate many components, including patient history, physical examination, diagnostic study outcomes, summary statement, evaluation and plan, clinical reasoning/synthesis of information, and general aspects, using a 5-point scale.	1

Michener-2020	USA	Medicine	The curriculum was developed in accordance with the 5Ms framework, which encompasses pre-recorded or live brief online didactics, readings, recordings, interactive cases, discussion board posts, and virtual group discussions.	Canvas	Canvas discussion board was used for real-time feedback throughout the course.	2
Prasad-2020	Australia	Medicine, Midwifery	Obstetric and Neonatal Simulation (ONE-Sim) workshop run in a remote learning, and students' mutual interaction and reflections on case-based scenarios. The course also included pre-reading, Case, and video online resources.	Zoom	-	1
Singh-2020	India	Medicine	Online classroom with videoconferencing	Google Meet, Google Classroom	-	1
Keylen-2020	Germany	Medicine	Adapted inverted classroom concept: Podcasts, audio annotated videos, asynchronous learning module the elective course "Smart Decision-making in Clinical Practice", and video consultations.	ILIAS, WebEx	At the end of the lecture, students evaluated their learning experience in accordance with Mayer's "Personalization Principle"	2
Vielsmeier-2020	Germany	Medicine	HTML 5 learning package with the authoring program Exelearning 2.6	Exelearning EvaSys, Zoom	The assessment of interactive patient case management was performed using the survey program EvaSys.	2
Williams-2020	USA	Medicine	Asynchronous Material: Recorded lectures, Online cases, Additional readings, and Discussion board posts. Synchronous Material: cumulative Live discussion sessions, Live lecture-urology department grand rounds, and Live student presentations. Problem-based learning cases (PBL) Evidence-based discussions.	Canvas, Blue Jeans	Using a 5-point Likert scale, participants' impressions of Urology were assessed before to and after the course.	2
Zhang-2020	China	Medicine	In a comparison of two online learning systems, Learning in ZJU and Ding Talk, the Traditional Chinese Medicine course was delivered in both live and recorded formats to students.	ZJU website, Ding Talk	Pre- and post-test.	2
Alpert-2020	USA	Medicine	1- Virtual Read-Out (VRO): a small-group educational session conducted by teleconferencing. Sessions were conducted among seven radiology subspecialties. 2- Conventional: Weekly subspecialty radiology rotations, when students accompany residents and fellows in radiology reading rooms to watch the interpretation of real-time imaging tests.	WebEx, Qualtrics application	-	2
Chin-2020	USA	Medicine	The study employs a hybrid format, with Fellows alternating weekly between on-site and remote work. On-site, participants don personal protection equipment and adhere to social distancing protocols. Colleagues use digital pathology to remotely examine cases and enhance their learning via online educational activities. Virtual "coffee breaks," meditation, and physical activity are included into the curriculum.	WebEx, Google Classroom, Canvas	Respondents were asked to evaluate the quality of remote compared with in-person educational experiences	1

Kan-2020	Singapore	Medicine	Virtual workshops addressing case-based situations, medical documentation, and inter-professional communication were executed using a video conferencing platform. Polling, small group conversations, and the chat feature were used to enhance participation. The instruction was delivered in a "hot seat" approach, whereby students were prompted to articulate their responses to case situations and engage with other healthcare professionals.	Poll Everywhere, Zoom	Pre-workshop and postworkshop survey were conducted, asking students to rate their confidence levels in performing tasks expected.	2
Kang-2020	South Korea	Nursing	Group 1 - Virtual Reality Simulation (vSim) group, using an educational simulation approach to deliver case situations. In the High-Fidelity Simulation (HFS) group, nursing scenarios were created based on the vSim patient cases. Group 3 use a mix of vSim and HFS for educational purposes.	-	Pre- and post-test assessing knowledge, confidence in practice, and performance after course. performance tool based on the clinical performance tool developed by Lee	2
Naidoo-2020	UAE	Medicine	The work delineates the amalgamation of Gagne's nine instructional events with Peyton's four-step technique via a mixed approach. The integrated processes include capturing students' attention, delivering information, offering instructional support, motivating performance, and facilitating retention and transfer.	Microsoft teams, WhatsApp, YouTube	Knowledge transfer was investigated by comparing the performance of students, multiple-choice question.	2
Parker-2020	USA	Medicine	Flexible classrooms, discussion boards, case-based exercises, lectures, and virtual slides are all included in this distance learning course. Supervised by teaching assistants in small groups.	Zoom, PathPresenter.net, Canvas, Microsoft		
Zhou-2020	China	Nursing	Experimental group; control group; MOOC micro-video mixed mode; conventional theoretical instruction paired with clinical practice instruction.	-		
Shin-2020	USA	Medicine	Case-based virtual surgery clerkship curriculum.	Zoom		
Shih-2020	USA	Medicine	Written information about technique, physical sign demonstrated, common mistakes and clinical relevance, recorded video of techniques, and ZOOM tutorials.	Zoom	Assessment was conducted at the end of block in the form of objective structured clinical examination (OSCE) stations.	2
Costabile-2020	Australia	Medicine, Nutrition and Food Science, Pharmacy	Online simulations and hands-on skills face to face	-	-	1
Jiang-2021	China	pharmacy	Online teaching of medical molecular biology course. (1) Pre-class preparation; (2) live broadcasting; (3) post-class activities. Rain class and TenCent meeting as tool of lecturing.	WeChat, Siyuanxuetang–XJTU	Post-class quizzes were used to promote students reviewing the contents of lecturing when every chapter was finished. Final examination was traditional classroom-based examination.	1

Mobasher-2020	Iran	Medicine and Dentistry	Case analysis, case presentation, and book review. Through a series of self-study resources to examine examples that were publicly accessible on the university's LMS platform, the core ideas of medical ethics were taught in this adapted curriculum. In order to participate in the case study and discussion of the presented problem, the students engaged with one another in the online course.	Learning Management System (LMS) platform.	-	2
Murdock-2020	USA	Medicine	Virtual morning report (VMR).	Zoom	-	2
Suppan-2020	Switzerland	Medicine	Before responding to a series of post-intervention questions, the control group was presented the recommendations. Immediately after the instructions and before to responding to post-intervention questions, the gamified e-learning module was shown to the e-intervention group. Learning mechanisms included gamification, embedding videos, feedback, pretesting, and preventing material skipping.	Joomla 3.9 LMS Acy Mailing 5.1 distribution lists Articulate Storyline 3	Pretest and Post questions	2

Problem-based learning (PBL), Multiple choice questions (MCQs), Students' Evaluation of Educational Quality (SEEQ) the Learning Management System (LMS). All studies are referenced in Appendix 1.

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Original Article

Perception, Participation, and Limitations in Research Among Undergraduate Health Professionals: A Descriptive Study

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Abstract

Background: Undergraduate health professionals frequently lack awareness of research and demonstrate limited participation due to insufficient opportunities, inadequate training, and the perception that research is irrelevant to clinical practice. However, their involvement is crucial for advancing medical knowledge.

Objectives: This study aimed to assess undergraduate healthcare students' perceptions and participation in research, identify perceived barriers, and collect their recommendations for improving engagement.

Methods: This cross-sectional study was conducted at Lahore Medical & Dental College with 1514 medical, dental, and allied health science participants. Data were collected using a five-section questionnaire covering demographics, perceptions, participation, limitations, and recommendations. SPSS version 22.0 was used for reliability, descriptive, and inferential statistical analysis.

Results: Among 1514 students, 76.5% acknowledged the importance of research. However, 77.8% had neither attended a research course/module nor participated in a project, and 44.9% had never planned a research question. The primary barrier was the lack of perceived relevance, with 32.3% unaware of the research. For improvement, 60.3% recommended establishing a research support center, and 56.6% emphasized the need for qualified, research-oriented mentors.

Conclusion: The findings highlight the need to enhance research engagement among undergraduate healthcare professionals. Limited awareness, supervision, and funding contribute to poor participation. Universities should integrate research modules into the curriculum, conduct workshops, and provide necessary resources to promote student involvement.

Keywords: Knowledge; Perception; Research; Health Professionals

Background

Research is pivotal in the advancement of all academic disciplines. In today's dynamic world, driving innovation across fields, including medicine, is essential (1). In addition to exploration of new findings, medical research inculcates critical thinking and analytical skills of healthcare professionals. Health professionals can play a crucial role in advancing the field of medicine through their participation in research. They have the potential to contribute significantly to our understanding of diseases and developing new treatments and therapies (2). However, undergraduate health professionals often have limited exposure to research due to inadequate opportunities, lack of training, and the misconception that research is irrelevant to clinical practice (3). Such limitations hinder their ability to contribute meaningfully to medical progress.

At admission, undergraduate health professionals possess varying degrees of previous research experience. Multiple factors, including institutional background, pre-medical education, personal interests, and the influence of teachers or role models, can shape and influence their perception of research (4). Despite these differences, most undergraduates view research as a valuable component of their

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education and future careers, acknowledging its role in enhancing knowledge and improving patient care (5). However, their engagement is frequently constrained by limited access to research opportunities, insufficient exposure to research methodologies, and inadequate training. Moreover, some students misconceive that research lacks relevance to clinical practice. The lack of institutional and government support for research is a broader issue, contributing to the persistent disconnect between scientific knowledge and its application. Growing concern in developing countries emphasizes the need to promote research and bridge this gap (6).

To better engage undergraduate health professionals in research and harness their potential contributions, it is essential to understand their perceptions, levels of participation, and the limitations they encounter. Accordingly, this study was designed to assess undergraduate healthcare students' perceptions and participation in research, identify their challenges, and gather recommendations for improving research involvement. The findings aim to inform strategies for addressing these limitations and fostering a more research-positive mindset among students.

Objectives

This study aimed to assess undergraduate healthcare students' perceptions and participation in research, identify perceived barriers, and collect their recommendations for improving engagement.

Methods

This cross-sectional study was conducted at Lahore Medical & Dental College, Lahore, from January 2023 to July 2023 (Ethical Review No: LMDC/22796), involving 1514 students from MBBS, BDS, Pharm D, BS Nutrition, and BS Biotechnology programs. A sample size of 670 was calculated using Open-Source Epidemiologic Statistics for Public Health (OpenEPI) with a 95% confidence interval for an estimated population of 2600 (7). Convenience sampling was employed, and all 1514 students who volunteered were included, increasing the confidence level to 99%. The study instrument was a structured questionnaire developed based on findings from preliminary literature on undergraduate research involvement in health sciences (8-10). It comprised five sections: demographics, perceptions, participation, limitations, and recommendations. The perception section contained three questions, while the participation, limitations, and recommendations sections included seven, five, and seven questions, respectively. The questionnaire featured multiple-choice items, checkboxes, Yes/No questions, and 4-point Likert scales. Frequencies were calculated for each question, recording the number of students selecting each response (such as 'Yes' or 'No') and the level of agreement. This methodology enabled a detailed distribution of responses and provided a comprehensive overview of participants' perspectives. Responses to Likert scale questions were summed to create composite scores for perception and participation, which were then compared across disciplines. Questionnaire reliability was assessed using Cronbach's alpha. The Content Validity Index (CVI) was determined for each item (I-CVI) and the entire scale (S-CVI), with an acceptable threshold set at 0.83 (11, 12).

Informed consent was obtained from all participants, and confidentiality of responses was assured. Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) statistical software (version 22.0, International Business Machines Corporation, New York, USA). Normality was tested via the Kolmogorov–Smirnov test, with values > 0.05 indicating normal distribution. Descriptive statistics are presented as frequencies and percentages. Chi-square tests assessed associations between yes/no responses and gender or residential status. Composite perception and participation scores were compared across disciplines using analysis of variance (ANOVA), with significance set at $p < 0.05$. Post-hoc Tukey's test identified group differences.

Results

Table 1 presents participants' demographics: 1514 students participated, including 1078 (71.1%) women and 437 (28.8%) men. The reliability of the questionnaire was 0.78. The I-CVI values ranged from 0.83 to 1, with an overall S-CVI of 0.96. The minimum acceptable Content Validity Ratio (CVR) per item was 0.83, with an average CVR of 0.95.

Table 2 details students' perceptions and participation in research. Most (76.5%) agreed that research is necessary, 15.3% were neutral, and 7.2% disagreed. Nearly half (44.9%) had never planned to design a research question. Moreover, 77.8% had neither attended research courses/workshops nor participated in research projects. Chi-square tests revealed no significant association between participation and gender or residential status (Table 3).

ANOVA showed significant differences in perception scores among MBBS, BDS, and DPT students (Table 4), with Tukey's Honestly Significant Difference (HSD) test indicating higher perception scores for MBBS students than for BDS and DPT (Table 4).

Figure 1 illustrates the reported research limitations. The primary barrier was the lack of perceived importance, with 32.3% unaware of the research. Other notable limitations included insufficient funding (16.4%) and inadequate supervision/counseling (28.1%). Figure 2 summarizes recommendations to enhance research involvement: 60.3% proposed establishing research support centers, 56.6% advocated for qualified, research-oriented mentors, and 57.7% recommended workshops to improve understanding. Moreover, 43.8% suggested organizing undergraduate research competitions.

Discussion

This study highlights valuable insights into the perceptions and participation of undergraduate health professionals in research activities. A majority recognized the importance of research in their academic journey and expressed their interest in research projects. However, most had minimal hands-on research experience, consistent with findings from previous studies (13). Medical students lacking exposure to research opportunities or formal training lack the necessary skills and knowledge to contribute meaningfully to the medical field (14). A researcher's perception of their field strongly influences their attitude, motivation, and engagement. In the present study, some participants displayed disinterest in research. This finding is supported by previous findings reporting low enthusiasm for research, even at the postgraduate level, among faculty in medical institutions across Pakistan (15). El Achi et al. (2020) reported that students who perceive research as irrelevant to clinical practice often perceive it as abstract and disconnected from real-world medicine, diminishing their engagement (8). One possible reason for this disinterest could be the curriculum prioritizing theoretical instruction over experimental research. These results align with the findings by Khan et al. (2009), who reported greater interest in research among students enrolled in problem-based learning programs compared to those in traditional lecture-based settings (16).

Conversely, a positive attitude toward research is observed in many countries despite common barriers (such as lack of funding, time constraints, inadequate knowledge, and limited supervision) (6). Students who participated in research in the current study reported positive outcomes, describing the experience as beneficial. These findings align with previous studies that reported early research involvement as essential for enhancing critical thinking and academic performance (17, 18).

Among the identified limitations, lack of funding and resources were prominent, echoing previous reports that limited access to research infrastructure is particularly challenging for students in rural or under-resourced settings (19). Moreover, inadequate supervision and mentorship were major obstacles. These findings are supported by studies highlighting the shortage of experienced research mentors (9), which contributes to insufficient training and a lack of confidence in conducting research (20). Although students are trained in clinical competencies, they often lack the methodological skills to design, implement, and analyze research projects, hampering their ability to contribute to the scientific community (20). Time constraints due to heavy academic workloads were another commonly cited limitation; this finding aligns with findings by Memarpour et al., (2015) (6) who identified similar challenges. Many students suggested that research should be integrated as a mandatory component of undergraduate education. Research is often treated as optional or secondary, discouraging student participation and limiting their academic growth. A lack of recognition and incentives for research contributions further demotivates students. These findings echo the concerns of Arshad et al., who reported that students desired rewards, such as incentives for publication, to justify their time investment in research (13). Moreover, many students were unaware of available research opportunities and found it difficult to balance research with academic responsibilities—concerns also documented in earlier studies (9, 21). Encouragingly, participants strongly preferred structured research training through workshops, mentorship programs, and the establishment of dedicated research support centers. These recommendations align with best practices cited in the literature to enhance undergraduate research engagement (22, 23).

To overcome these limitations, medical universities must prioritize integrating research into undergraduate medical education. Students can be encouraged through structured research opportunities, curriculum-based research training, and emphasis on its clinical relevance. Government support is crucial in providing funding and resources. Policymakers should revise existing policies and implement initiatives that foster research progress. These efforts will help cultivate a more research-positive mindset among medical students, preparing future healthcare professionals to meet evolving challenges in the field.

Conclusion

Medical students hold significant potential to contribute to the advancement of medicine through research. However, limited awareness, poor perception, and other barriers impede their engagement. This study highlights the urgent need to enhance undergraduate research involvement. Most students lack the practical exposure and planning for meaningful participation, highlighting a substantial educational gap. Bridging this gap requires integrating research modules into the curriculum, conducting targeted workshops, and ensuring access to supportive resources that facilitate undergraduate research engagement.

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Conflict of interests: There is no conflict of interest.

Ethical approval: This cross-sectional study was conducted at Lahore Medical & Dental College, Lahore, from January 2023 to July 2023 (Ethical Review No: LMDC/22796).

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References

1. Gostin LO, Levit LA, Nass SJ. Beyond the HIPAA privacy rule: enhancing privacy, improving health through research. Washington (DC): National Academies Press (US); 2009: 3.
2. Knight SL, Hale RL, Chisholm LJ, Moss P, Rolf C, Wenner L. Increasing student involvement in research: a collaborative approach between faculty and students. Int J Nurs Educ Scholarsh. 2021 Nov 3;18(1). doi: 10.1515/ijnes-2021-0047. [PMID: 34731932]
3. Kumar J, Memon A, Kumar A, Kumari R, Kumar B, Fareed S. Barriers Experienced by Medical Students in Conducting Research at Undergraduate Level. Cureus. 2019 Apr 13;11(4):e4452. doi: 10.7759/cureus.4452. [PMID: 31205838] [PMCID: PMC6561510]
4. Ditta AS, Strickland-Hughes CM, Cheung C, Wu R. Exposure to information increases motivation to learn more. Learn Motiv. 2020 Nov:72:101668. doi: 10.1016/j.lmot.2020.101668. [PMID: 32934422] [PMCID: PMC7483035]
5. Jimmy R, Palatty PL, D'Silva P, Baliga MS, Singh A. Are medical students inclined to do research?". J Clin Diagn Res. 2013 Dec;7(12):2892-5. doi: 10.7860/JCDR/2013/6698.3786. [PMID: 24551667] [PMCID: PMC3919354]
6. Memarpour M, Fard AP, Ghasemi R. Evaluation of attitude to, knowledge of and barriers toward research among medical science students. Asia Pac Fam Med. 2015 Feb 11;14(1):1. doi: 10.1186/s12930-015-0019-2. [PMID: 25705121] [PMCID: PMC4336721]
7. Sullivan KM, Dean A, Soe MM. OpenEpi: a web-based epidemiologic and statistical calculator for public health. Public Health Rep. 2009 May-Jun;124(3):471-4. doi: 10.1177/003335490912400320. [PMID: 19445426] [PMCID: PMC2663701]
8. El Achi D, Al Hakim L, Makki M, Mokaddem M, Khalil PA, Kaafarani BR, et al. Perception, attitude, practice, and barriers towards medical research among undergraduate students. BMC Med Educ. 2020 Jun 17;20(1):195. doi: 10.1186/s12909-020-02104-6. [PMID: 32552801] [PMCID: PMC7298799]
9. Assar A, Matar SG, Hasabo EA, Elsayed SM, Zaazouee MS, Hamdallah A, et al. Knowledge, attitudes, practices, and perceived barriers towards research in undergraduate medical students of six Arab countries. BMC Med Educ. 2022 Jan 18;22(1):44. doi: 10.1186/s12909-022-03121-3. [PMID: 35042492] [PMCID: PMC8767733]
10. Kanmounye US, Tochie JN, Temgoua M, Mbonda AN, Endomba FT, Nkeck JR, et al. Barriers and facilitators of research in Cameroon (Part I)-an e-survey of physicians. PAMJ Clinical Medicine. 2020;4(58): 1-18. doi:10.11604/pamj-cm.2020.3.83.23716.
11. Yusoff MSB. ABC of content validation and content validity index calculation. Education in Medicine Journal. 2019;11(2):49-54. doi:10.21315/eimj2019.11.2.6.
12. Lawshe CH. A quantitative approach to content validity. Personnel Psychology. 1975;28(4):563-75. doi:10.1111/j.1744-6570.1975.tb01393.x.
13. Arshad S, Huda NU, Nadeem N, Ali S, Ahmad N, Anwar S, et al. Perceptions of Medical Students About Research at Undergraduate Level. J Ayub Med Coll Abbottabad. 2021 Jan-Mar;33(1):129-33. [PMID: 33774969]
14. Murdoch-Eaton D, Drewery S, Elton S, Emmerson C, Marshall M, Smith JA, et al. What do medical students understand by research and research skills? Identifying research opportunities within undergraduate projects. Med Teach. 2010;32(3):e152-60. doi: 10.3109/01421591003657493. [PMID: 20218832]
15. Sabzwari S, Kauser S, Khuwaja AK. Experiences, attitudes, and barriers towards research amongst junior faculty of Pakistani medical universities. BMC Med Educ. 2009 Nov 16:9:68. doi: 10.1186/1472-6920-9-68. [PMID: 19917109] [PMCID: PMC2780986]
16. Khan H, Khan S, Iqbal A. Knowledge, attitudes, and practices around health research: the perspective of physicians-in-training in Pakistan. BMC Med Educ. 2009 Jul 17:9:46. doi: 10.1186/1472-6920-9-46. [PMID: 19615071] [PMCID: PMC2719622]
17. Yuan R, Yang M, Stapleton P. Enhancing undergraduates' critical thinking through research engagement: A practitioner research approach. Thinking Skills and Creativity. 2020;38:100737. doi:10.1016/j.tsc.2020.100737.

18. Adebisi YA. Undergraduate students' involvement in research: Values, benefits, barriers, and recommendations. Ann Med Surg (Lond). 2022 Aug 17:81:104384. doi: 10.1016/j.amsu.2022.104384. [PMID: 36042923] [PMCID: PMC9420469]
19. Akhtar T, Khan JA. Health research capacity in Pakistan. A country report prepared for the WHO and COHRED Regional Consultation on Health Research for Development: Egypt, Cairo. 2000.
20. Bilal M, Haseeb A, Mari A, Ahmed S, Sher Khan MA, Saad M. Knowledge, Attitudes, and Barriers Toward Research Among Medical Students of Karachi. Cureus. 2019 Sep 9;11(9):e5599. doi: 10.7759/cureus.5599. [PMID: 31700712] [PMCID: PMC6822902]
21. Awofeso OM, Roberts AA, Okonkwor CO, Nwachukwu CE, Onyeodi I, Lawal IM, et al. Factors affecting undergraduates' participation in medical research in lagos. Niger Med J. 2020 May-Jun;61(3):156-162. doi: 10.4103/nmj.NMJ_94_19. [PMID: 33100468] [PMCID: PMC7547749]
22. Mugabo E, Velin L, Nduwayezu R. Exploring factors associated with research involvement of undergraduate students at the College of Medicine and Health Sciences, University of Rwanda. BMC Med Educ. 2021 Apr 26;21(1):239. doi: 10.1186/s12909-021-02662-3. [PMID: 33902555] [PMCID: PMC8072743]
23. Murray H, Payandeh J, Walker M. Scoping Review: Research Training During Medical School. Med Sci Educ. 2022 Nov 10;32(6):1553-1561. doi: 10.1007/s40670-022-01679-7. [PMID: 36532387] [PMCID: PMC9755431]

Table 1. General Information of the study participants

Variable	Category	Frequency (f)	Percentage (%)
Total number of participants	n	1514	100
Gender	Female	1078	71.1
	Male	437	28.9
Residential Status	Day Scholar	367	24.2
	Hostelite	1147	75.8
Mother's Education	Matric / O levels	342	22.6
	F Sc / A levels	312	20.6
	Bachelors	507	33.5
	Postgraduate	352	23.2
Father's Education	Matric / O levels	207	13.7
	F Sc / A levels	257	16.9
	Bachelors	479	31.7
	Postgraduate	571	37.7
Year of Study	1st Year	618	40.8
	2nd Year	386	25.5
	3rd Year	195	12.9
	4th Year	153	10.1
	5th Year	162	10.7
Discipline	MBBS	491	32.4
	BDS	144	9.5
	DPT	386	25.5
	PharmD	441	29.1
	BS Biotechnology	34	2.2
	BS Nutrition	18	1.1

n = sample size, Data is presented as frequencies and percentages

Table 2. Perception and participation of students towards research

Variable	Category	Frequency (f)	Percentage (%)
Do you think that research is important for undergraduate students?	Strongly Disagree	67	4.4
	Disagree	58	2.8
	Neutral	231	15.3
	Agree	455	30.1
	Strongly Agree	703	46.4
Extent of your interest in participating in research at undergraduate level?	Not Interested	104	6.9
	Interested	772	51.0
	Very Interested	638	42.1
Have you ever planned to design a research question?	Never	680	44.9
	Occasionally	668	44.1
	Many Times	166	11.0

Have you attended any research course/module or workshop?	Yes	336	22.2
	No	1178	77.8
Have you ever been a part of any research project?	Yes	338	22.3
	No	1176	77.7
If you have participated in research, was the process beneficial?	Yes	1407	92.9
	No	107	7.1
If you have participated in research, have you ever published any study?	Yes	1428	94.3
	No	86	5.7

Data is presented as frequencies and percentages

Table 3. Association of research participation with residential status and Gender

Variable	Participation in research			
	Yes	No	p value	OR and CI
Residential Status	n	1514	100	
Day scholar	263	884	0.34	1.1 (0.86-1.5)
Hostelite	75	292		
Gender				
Male	105	331	0.30	1.1 (0.88-1.4)
Female	233	845		

Chi square test of association, OR: Odds Ratio, CI: 95% Confidence Interval, p value < 0.05 considered significant

Table 4. Differences Across Various Disciplines Regarding Perception of Research

Variable	p-value (ANOVA)	Group	Mean (SD)	Post Hoc Tukey Test	Mean Difference (95% CI)
Perception of Research	0.001*	MBBS (a)	4.24 (0.9)	a-b: <0.01*	0.40 (0.11–0.69)
		BDS (b)	3.84 (1.2)	a-c: <0.05*	0.21 (0.01–0.42)
		DPT (c)	4.02 (1.0)	b-c: >0.05	-0.18 (-0.48–0.11)

p value calculated by ANOVA and Post Hoc Tukey Test, 95 % CI: Confidence Interval, *significant p value < 0.05

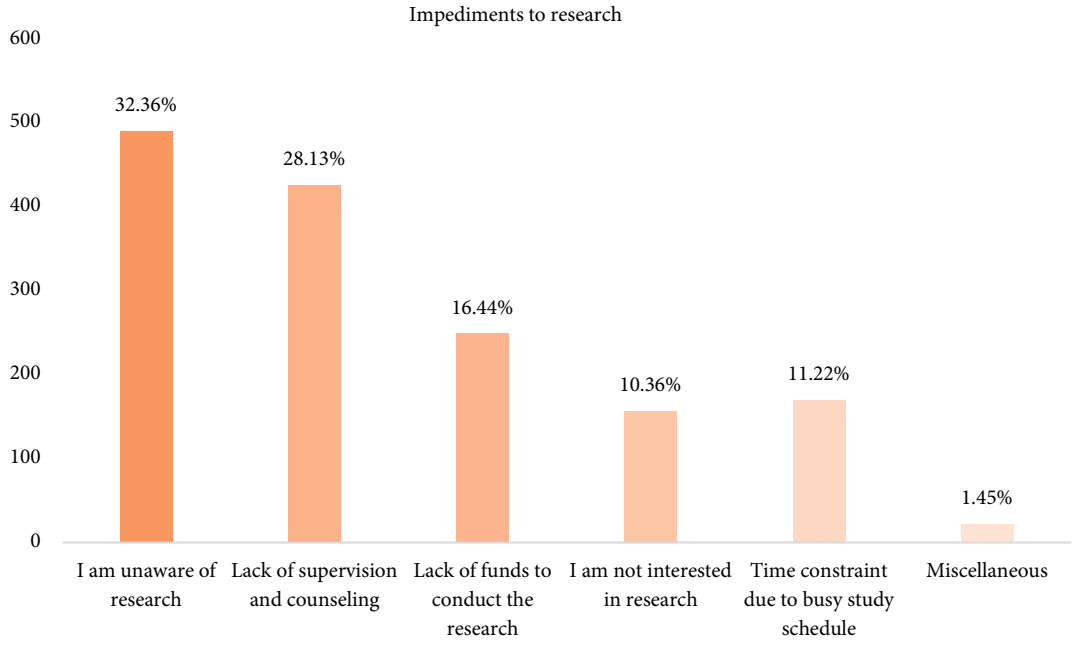

Figure 1. Percentages of students for various impediments to research

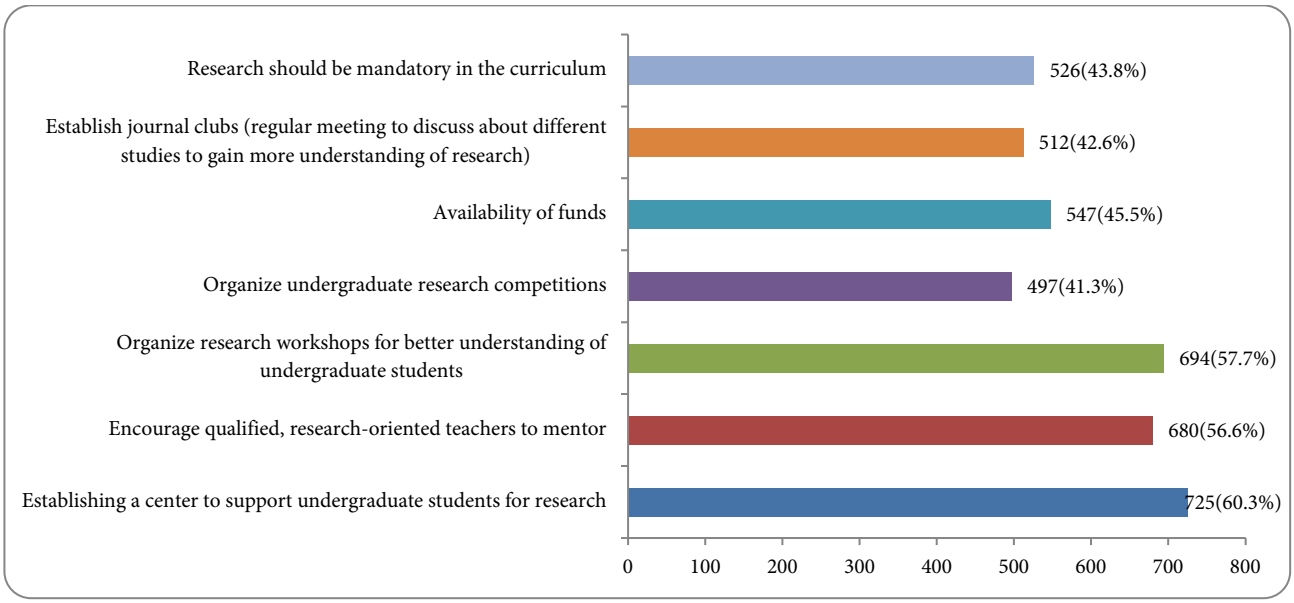

Figure 2. Frequencies and percentages of students for various recommendations to improve research involvement among undergraduate health professionals

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Original Article

The Role of Academic and Individual Factors in the Academic Engagement of Dental Students in Babol, Northern Iran: A Structural Equation Modeling Approach

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Abstract

Background: Academic engagement in medical education, particularly within the field of dentistry, is a topic of considerable interest to both academic staff and policymakers. Nevertheless, there remains a need for more extensive research into the individual and academic factors influencing this engagement.

Objectives: The current research investigated the relationships among individual and academic variables and the academic engagement observed in dental students at Babol, Northern Iran.

Methods: This cross-sectional study, conducted in 2023 at Babol University of Medical Sciences in northern Iran, investigated academic engagement among dental students. A total of 315 students (55.9% female) were recruited using a cluster random sampling method. Data collection involved a demographic questionnaire, the Student Engagement in School Questionnaire (SESQ), and measures of individual and academic factors associated with academic engagement. Pearson correlation and structural equation modeling (SEM) were employed for statistical analysis. The significance level for all statistical tests was set at 0.05.

Results: The ultimate path model substantiated that academic factors, encompassing the learning-teaching environment, servant leadership, staff-student interaction, available equipment, welfare amenities, and scientific and extracurricular spaces, significantly influenced perceived academic engagement. These factors exerted both direct ($\beta = 0.20$, $p = 0.002$), and indirect ($\beta = 0.35$, $p < 0.001$) positive effects on academic engagement. Furthermore, individual factors (such as self-efficacy, time management, hope, and support from family and friends) were identified as significant mediators of perceived academic engagement ($\beta = 0.74$, $p < 0.001$).

Conclusion: Academic engagement among dental students at Babol is notably shaped by a combination of academic and individual elements. Universities have the capacity to foster greater engagement by elevating the caliber of their learning-teaching environment. Concurrently, students can cultivate their own academic engagement through the cultivation of hope.

Keywords: Academic Success; Engagement; Students; Dental; Education; Medical; Hope; Learning; Structural Equation Modeling

Background

Academic engagement, which involves cognitive, emotional, and behavioral aspects, is vital for improving the quality of education and promoting academic success (1-3). Recently, there has been a significant focus by university staff and education policymakers on academic engagement among students in medical disciplines, including dentistry. Cognitively engaged

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students demonstrate active participation in learning, critical analysis of information, and a pursuit of profound understanding. Concurrently, emotional engagement encompasses positive affect toward academic pursuits, intrinsic motivation to learn, and a sense of belonging within the academic setting. Behavioral engagement is characterized by active participation, diligent study habits, and a dedicated approach to academic responsibilities (4, 5). Nevertheless, despite the acknowledged significance of academic engagement, there is a limited understanding of its influential factors, especially concerning the interplay between individual and academic environmental variables.

Earlier studies have emphasized the complex characteristics of academic engagement and its relationship with different personal and academic environmental elements. Factors like self-efficacy (6), time management (7), hope (8), and support from family and friends (9) have been recognized as possible factors affecting academic engagement. Academic environmental factors are also acknowledged as influential, encompassing the learning-teaching environment (10, 11), servant leadership (12, 13), staff-student interaction (14), available equipment (15), welfare amenities, and scientific and extracurricular spaces (14, 16, 17). Grasping the influential factors behind the various facets of academic engagement is essential for crafting effective strategies to bolster student learning and success, especially within challenging disciplines like dentistry.

Objectives

This research utilizes a structural equation modeling (SEM) approach to explore how both academic and individual factors influence the academic engagement of Iranian dental students. By examining these complex relationships, this research offers significant insights into the determinants of student success within this challenging discipline.

This study's findings are expected to significantly benefit university administrators, educators, and policymakers within medical education. By identifying the primary determinants of academic engagement, this research aims to inform the creation of targeted interventions and support systems aiming to cultivate a more engaged and successful learning environment specifically for dental students.

Methods

This cross-sectional study was undertaken in 2022, enrolling all dental students at Babol University of Medical Sciences and Health Services. A cluster random sampling method was employed to ensure representation across all academic terms. From a comprehensive list of student names, with each term constituting a distinct cluster, a total of 315 participants were selected. Participation in the study was entirely voluntary. The sample size for this study was calculated using Stata version 17 software for regression models. This calculation was informed by a prior study (14), which reported a beta coefficient of 0.23 for the relationship between academic factors and academic enthusiasm. Based on a previous study's parameter value (14), and aiming for a type I error rate of 5% and a type II error rate of 20%, a minimum of 102 samples was necessary. This calculation accounted for 10 test variables (individual and academic factors) and 83 control variables (items associated with these factors). This determination was made using the Stata command: Power error (0.23), tested (10), and control (82). Given that each semester must be sampled as a cluster, and acknowledging the potential for intra-cluster correlation among students within a class, the sample size requires upward adjustment. This is necessary to account for the violation of the assumption of participant independence. To determine the appropriate sample size for this study, we adjusted the sample size initially calculated by Stata software by incorporating a design effect (DEFF) of 3.0. This adjustment yielded a final required sample size of 306 participants. The design effect was calculated using the formula: $DEFF = 1+\delta\ (n-1)$. In this formula, δ represents the interclass correlation, and n denotes the average cluster size, which was set at 21 students per semester in this study. For this study, a value of $\delta = 0.1$ was assigned to represent academic enthusiasm. This specific index has not been utilized in prior research concerning students, and its current value was determined through expert consensus. Data were collected via paper questionnaires administered in person. The questionnaire commenced by clearly stating the study's objectives. Participants received assurances of anonymity and were informed that their data would be exclusively utilized for research purposes. The paramount ethical consideration guiding the study was the unwavering commitment to preserving human dignity. Verbal informed consent was secured from all student participants, who were apprised of their right to

withdraw from the study without penalty at any point. Prior to commencing the research, ethical approval was granted by Babol University of Medical Sciences.

Measures

The research tools utilized were as follows:

- Demographic and educational questionnaires were utilized to gather information on variables including age, gender, marital status, university entry year, and parents' education level.

- The Student Engagement in School Questionnaire (SESQ), originally developed by Hart et al. in 2011 (18), has demonstrated robust psychometric properties. In Iran, Nekavand et al. (14) further validated the instrument, confirming its acceptable reliability and validity. This 32-item, self-report questionnaire assesses student engagement across three distinct dimensions: Cognitive engagement (11 items), emotional engagement (9 items), and behavioral engagement (12 items). Responses are captured using a Likert scale, with scores ranging from 0 ("very little") to 4 ("very much"). The total score on the SESQ can range from a minimum of 0 to a maximum of 128.

- The Questionnaire of Factors Influencing Academic Engagement, developed by Nekavand et al. (14), is a 93-item instrument designed to assess various elements contributing to academic engagement. This questionnaire categorizes these factors into two main areas: Individual factors (including self-efficacy, time management, hope, and support from family and friends) and academic factors (including the learning-teaching environment, servant leadership, staff-student interaction, available equipment, welfare amenities, and scientific and extracurricular spaces). The questionnaire utilized a Likert scale with responses ranging from 1 (completely disagree) to 5 (completely agree). Total scores for the questionnaire can range from a minimum of 93 to a maximum of 465. The questionnaire's face validity, content validity, and construct validity were thoroughly investigated. Furthermore, reliability testing yielded a Cronbach's alpha coefficient of 0.89 for the SESQ and 0.96 for the Questionnaire of Factors Influencing Academic Engagement (14).

In the current research, the reliability of the questionnaires was re-evaluated, yielding high internal consistency. Specifically, the SESQ demonstrated a Cronbach's alpha coefficient of 0.913, and the Questionnaire of Factors Influencing Academic Engagement showed a Cronbach's alpha of 0.958, both indicating excellent reliability.

Data Analysis: Descriptive statistics were computed for all variables. For quantitative data, the mean, standard deviation, minimum, and maximum values were determined. Frequencies and percentages were calculated for qualitative data. Pearson correlation coefficients were used to assess the relationships between factors. Finally, the proposed hypothetical model was evaluated and examined using SEM. In our assessment of the model's appropriateness, we utilized several established fit indices. These included the chi-square statistic, the comparative fit index (CFI), the Tucker-Lewis index (TLI), the standardized root mean square residual (SRMSR), and the root mean square error of approximation (RMSEA). For a model to demonstrate adequate fit, the chi-square to degrees of freedom (df) ratio should be below 5. Furthermore, TLI and CFI values exceeding 0.90 are indicative of a robust model fit. Moreover, SRMSR and RMSEA values less than 0.08 suggest an acceptable fit, while values below 0.05 denote a strong fit.

Results

The characteristics of the 315 participants in the present study are summarized in Table 1.

Table 2 presents the descriptive statistics for each factor, including their means, standard deviations, and Cronbach's alpha values.

Moreover, Pearson correlation coefficients (r) were calculated to examine the relationships among these factors. The correlations among the engagement factors (emotional, behavioral, and cognitive) ranged from 0.46 to 0.55. For individual factors, the correlation coefficients varied between 0.05 and 0.67. Finally, the academic factors exhibited correlations ranging from 0.11 to 0.59.

Structural Modeling: A final path analysis was conducted to assess the overall fit of the hypothesized model. The findings revealed a strong model fit, as corroborated by various fit indices. The model's chi-square value was 180.68 (χ^2 = 180.68, df = 60), yielding a chi-square to df ratio of approximately 3.01. This ratio falls within the acceptable range, satisfying the recommended threshold of $\chi^2/df < 5$. Complementary fit indices provided further evidence of the model's robust fit. Specifically, the CFI, TLI, and Standardized SRMSR were 0.92, 0.90, and 0.05, respectively. Additionally, a RMSEA of 0.07 indicated an acceptable fit of the model to the observed data (Figure 1).

The model demonstrated several notable direct effects. Specifically, academic factors exhibited direct, positive influences on academic engagement ($\beta = 0.20$, $p < 0.01$) and individual factors ($\beta = 0.49$, $p < 0.001$). Furthermore, individual factors had a direct, positive impact on academic engagement ($\beta = 0.74$, $p < 0.001$). The overall impact of academic factors on academic engagement was found to be both positive and statistically significant ($\beta = 0.55$, $p < 0.001$). Furthermore, the total indirect effect of academic factors on academic engagement also demonstrated a positive and significant relationship ($\beta = 0.35$, $p < 0.001$). Specifically, this significant indirect effect was observed when academic factors influenced academic engagement through individual factors ($\beta = 0.35$, $p < 0.001$) (Table 3).

Discussion

This study reveals the substantial impact of both academic and individual factors on the academic engagement of Iranian dental students. Specifically, academic elements (such as the learning-teaching environment, servant leadership, staff-student interaction, equipment, welfare amenities, and scientific and extracurricular spaces) demonstrate a direct positive correlation with academic engagement. This outcome is consistent with prior research underscoring the critical role of a supportive and enrichingacademic environment in promoting student engagement (10, 13, 14).

Consistent with the findings of Nekavand et al.'s research (14), this study's results demonstrate a more significant influence of individual factors on academic motivation. This could be attributed to the potential mediation of academic factors' effects through individual factors.

The learning-teaching environment stands out as the most impactful academic factor. This highlights the critical role played by positive and supportive interactions between instructors and students, the use of effective teaching methods, and the creation of a generally conducive classroom atmosphere (16). These elements altogether form the educational experience by fostering active participation, motivation, and a sense of belonging among students. Consistent with prior research (19, 20), this study also found a teacher-student interaction, the learning-teaching environment, the enhancement of student extracurricular activities, and servant leadership concerning academic enthusiasm. Moreover, Huang et al. (16) established a significant direct positive correlation between the university atmosphere and students' academic motivation. They found that increased student engagement in learning activities within the university setting, coupled with a pedagogical shift from subject- and teacher-centered instruction to a student-centered approach emphasizing greater student interaction, culminates in enhanced academic motivation. These findings align with the current study. Among the academic factors, “equipment” and “welfare amenities” were identified as the most influential, following the teaching-learning environment, in terms of factor loading. This consistency is further supported by numerous studies indicating that the inadequate provision of sports, educational, and health equipment and facilities in schools detrimentally impacts the overall quality of educational institutions (21).

Individual factors, including self-efficacy, time management, hope, and support from family and friends, demonstrate a significant direct correlation with academic engagement. Of these factors, “hope” was identified as the most potent predictor, consistent with prior research emphasizing its beneficial influence on both academic achievement and resilience (8, 22). In the realm of individual psychological factors, “hope” consistently demonstrates the strongest influence. Students exhibiting higher levels of hope are more inclined to establish and pursue achievable objectives, sustain their engagement, and surmount challenges with greater efficacy. Rand et al.’s (23) research indicates that both hope and optimism serve as significant predictors of students' academic performance and overall mental well-being. Snyder et al. (24) found a strong correlation between elevated levels of hope and positive academic outcomes in college students, including superior overall average grades, higher academic performance, and accelerated graduation rates. Similarly, Khoroushi et al. (25) demonstrated that student self-efficacy and time management skills contribute to increased enthusiasm, which, in turn, facilitates enhanced learning and academic progress. Sohrabi et al. (26) found a significant relationship between time organization, time management behaviors, and academic performance. This finding corroborates the results observed in the present study concerning the time management component.

The study's findings indicate that individual factors exert a greater influence on academic engagement than academic factors do. This phenomenon can be explained by the mediating role of individual factors in the relationship between academic factors and academic engagement. Specifically, the effect of academic factors

on engagement is partially mediated by individual factors, indicating an intricate interaction among these variables.

While this study found that scientific and extracurricular spaces, along with support from family and friends, had the least explanatory power, it is crucial to acknowledge their demonstrated significance in prior research (27, 28). These divergent results may be attributed to the specific contextual factors of the current study, including the homogeneity of the sample and the participants' age and developmental stage.

Limitations: There were several limitations for this study. Firstly, the participant pool was drawn exclusively from a single faculty at one university, resulting in a considerable degree of homogeneity among the students and encompassing both their individual and academic factors. Such homogeneity might account for the observation that individual factors exhibited a higher regression coefficient compared to academic factors. The impact of academic factors might have been more significant if participants had been drawn from a more diverse range of faculties and possessed a wider array of academic factors. To improve the generalizability of these results, future studies should include participants from multiple universities. Additionally, the current research treated the substructures of individual and academic factors, as well as the dimensions of academic engagement, as observed variables. The current study's limited sample size precluded the treatment of certain variables as latent variables, as this could have compromised the achievement of model convergence. To mitigate the risk of measurement error in future research, particularly when analyzing factors across diverse substructures, it is advisable to employ larger sample sizes. Third, the study's reliance on self-report data and the extensive number of survey items (125 items) may have led to respondent fatigue, potentially diminishing the accuracy of responses to later questions and increasing measurement error. Ultimately, the cross-sectional design of the study precludes the establishment of causal inferences among the investigated relationships.

Conclusion

This study underscores the substantial impact of both academic and individual factors on the academic engagement levels observed among Iranian dental students. To foster improved student engagement, universities should focus on optimizing the learning-teaching environment. This includes promoting positive interactions between instructors and students, implementing effective pedagogical approaches, and cultivating a supportive and conducive classroom atmosphere. Cultivating academic engagement can also be achieved through the provision of varied learning opportunities, the promotion of servant leadership principles, the assurance of appropriate facilities and equipment, and the availability of extracurricular activities.

This study emphasizes the significant role of individual attributes, specifically hope, self-efficacy, and time management, in fostering academic engagement. Students can cultivate greater involvement in their studies by nurturing optimism, establishing attainable objectives, demonstrating resilience in the face of difficulties, and refining their time management skills. Moreover, developing supportive relationships with family and friends can also contribute to heightened academic engagement.

While academic and individual factors exert varying degrees of influence, comprehending their complex interactions and the mediating role of individual factors in academic engagement is crucial. Therefore, to cultivate a more engaging and successful learning environment for dental students, it is recommended to implement holistic interventions and support systems that address both academic and individual dimensions.

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Conflict of interests: There is no conflict of interest.

Ethical approval: This research was conducted in adherence to the Declaration of Helsinki and good clinical practices. Approval for this project was granted by the Research Ethics Committee of Babol University of Medical Sciences (Ethics Code: IR.MUBABOL.HRI.REC.1401.202).

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References

1. Fredricks JA, Blumenfeld PC, Paris AH. School Engagement: Potential of the Concept, State of the Evidence. Review of Educational Research. 2004; 74(1): 59-109. doi:10.3102/00346543074001059.
2. Reeve J. A self-determination theory perspective on student engagement. Handbook of research on student engagement. Boston, MA: Springer US; 2012: 149-72.
3. Hosseinmardi AA, Ghorban Shiroodi S, Zarbakhshbahri MR, Tizdast T. The Relationship of Academic Engagement, School Engagement and School Belonging with Academic Achievement by Mediated the Academic Achievement Motivation in Male Students. Sociology of Education. 2022; 7(2): 178-89. doi: 10.22034/ijes.2021.534830.1123.
4. Kahu ER. Framing student engagement in higher education. Studies in Higher Education. 2013; 38(5): 758-73. doi:10.1080/03075079.2011.598505.
5. Trowler V. Student engagement literature review. The higher education academy. 2010;11(1):1-15.
6. Honicke T, Broadbent J. The influence of academic self-efficacy on academic performance: A systematic review. Educational Research Review. 2016;17:63-84. doi:10.1016/j.edurev.2015.11.002.
7. Wolters CA, Hussain M. Investigating grit and its relations with college students' self-regulated learning and academic achievement. Metacognition and Learning. 2015;10(3):293-311. doi:10.1007/s11409-014-9128-9.
8. Rand KL, Martin AD, Shea AM. Hope, but not optimism, predicts academic performance of law students beyond previous academic achievement. Journal of Research in Personality. 2011;45(6):683-6. doi:10.1016/j.jrp.2011.08.004.
9. Galligan SB, Barnett RV, Brennan MA, Israel GD. The Effects of Gender Role Conflict on Adolescent and Emerging Adult Male Resiliency. The Journal of Men's Studies. 2010;18(1): 3-21. doi:10.3149/jms.1801.3.
10. Lange RS. Pascarella, T. and Terenzin, P. How College Affects Students, A Third decade of Research. 2nd ed. San Francisco: Jossey-Bass; 2014: 2. doi:10.14426/jsaa.v2i2.70.
11. Elsayed Abdelhalim G, Mohamed Fouad Kamel N, Abd-ElRasoul SA-EF. Effect of Interactive Learning environment on Nursing Students' Engagement and Academic Self-Concept. Egyptian Journal of Health Care. 2020; 11(1): 384-98. doi:10.21608/ejhc.2021.175131.
12. Aboramadan M, Dahleez K, Hamad M. Servant leadership and academics' engagement in higher education: mediation analysis. Journal of Higher Education Policy and Management. 2020;42(6):617-33. doi:10.1080/1360080X.2020.1774036.
13. Lizzio A, Wilson K, Simons R. University Students' Perceptions of the Learning Environment and Academic Outcomes: Implications for theory and practice. Studies in Higher Education. 2002;27(1):27-52. doi:10.1080/03075070120099359.
14. Nekavand M, Jaafari P, Arasteh H. A Model for Promoting Academic Engagement in Medical Sciences Students. Iran J Med Educ. 2018;18:446-57. [In Persian]
15. Venn E, Park J, Andersen LP, Hejmadi M. How do learning technologies impact on undergraduates' emotional and cognitive engagement with their learning? Teaching in Higher Education. 2023;28(4):822-39. doi:10.1080/13562517.2020.1863349.
16. Huang SL, Fisher DL. Associations of the University Learning Environment with Academic Engagement and Satisfaction among Science Majors in Taiwan. Asia-Pacific Education Researcher (De La Salle University Manila). 2011;20(2):291.
17. Rezapour M, Khanjani N, Mirzaee M. Construct Validity of Maryland Safe and Supportive Schools Climate Survey in Iran: A Validation Study. International Journal of School Health. 2020;7(2):1-13. doi:10.30476/intjsh.2020.84914.1049.
18. Hart SR, Stewart K, Jimerson SR. The Student Engagement in Schools Questionnaire (SESQ) and the Teacher Engagement Form-New (TERF-N): Examining the preliminary evidence. Contemporary School Psychology. 2011;15(1):67-79. doi:10.1007/BF03340964.
19. Zahed A, Karimi Yousefi SH, MoeiniKia M. Psychometric Properties of the Scale of Interest in School. Educational and Scholastic studies. 2013;2(4):56-70. [In Persian]
20. Mogharab M, Nzteghi K, Sharifzade GR. Effects of lecture and team member teaching design on nursing student's learning and academic motivation. Modern Care Journal. 2013;10(3):173-82. [In Persian]
21. Hatamifar K, Kakoojooybari AS, Sarmadi MR. A Study of Students Satisfaction with Student Services at Payam Noor University. Quarterly Journal of Research and Planning in Higher Education. 2023;19(4):117-39.
22. Ouweneel E, Le Blanc PM, Schaufeli WB. Flourishing students: A longitudinal study on positive emotions, personal resources, and study engagement. The Journal of Positive Psychology. 2011;6(2):142-53. doi:10.1080/17439760.2011.558847.
23. Rand KL, Shanahan ML, Fischer IC, Fortney SK. Hope and optimism as predictors of academic performance and subjective well-being in college students. Learning and Individual Differences. 2020;81: 101906. doi:10.1016/j.lindif.2020.101906.
24. Snyder CR, Shorey HS, Cheavens J, Pulvers KM, Adams Iii VH, Wiklund C. Hope and academic success in college. Journal of Educational Psychology. 2002;94(4):820-6. doi: 10.1037/0022-0663.94.4.820.
25. Khoroushi P, Nili MR, Abedi A. Relationship between "Cognitive and Emotional Engagement of Learning" and "Self-Efficiency" of Students Farhangian University of Isfahan. Educ Strategy Med Sci. 2014; 7 (4): 229-34. [In Persian]
26. Sohrabi Z, Ghovati F, Mirhosseini F, Hosseini F. The relationship between achievement motivation and time management and academic achievement Undergraduate Medical University of Medical Sciences. Razi Journal of Medical Sciences. 2016;23(150):35-45.
27. Aghamirzayi T, Salehi Omran E. Analysis of the effective factors on student progress: A Case Study in the Mazandaran University of Sciences & Technology. Higher Education Letter. 2013;5(20):117-40. [In Persian]
28. Bayanfar PD, F, Partonejad N, Tabatabaee PD. Predicting Students' Academic Engagement Based on Academic Support and Family Emotional Climate: The Mediating Role of Academic Emotions. Quarterly Journal of Family and Research. 2022;18(4):31-48. [In Persian]

Table 1. The demographic characteristics of participants according to frequency and percentage (N = 315)

Variable	Variable subgroup	n (%)
Gender	Male	139 (44.1)
	Female	176 (55.9)
Age	Below 20	88 (27.9)
	20-25	197 (62.5)
	Above 25	30 (9.5)
Marital status	Single	298 (94.6)
	Married	17 (5.4)
Father's education level	Below diploma	14 (4.4)
	Diploma	62 (19.7)
	Bachelor's degree	112 (35.6)
	Master's degree and above	127 (40.3)
Mother's education level	Below diploma	28 (8.9)
	Diploma	85 (27)
	Bachelor's degree	115 (36.5)
	Master's degree and above	87 (27.6)
Semester	1	22 (7)
	2	31 (9.8)
	3	13 (4.1)
	4	35 (11.1)
	5	10 (3.2)
	6	41 (13)
	7	11 (3.5)
	8	40 (12.7)
	9	15 (4.8)
	10	39 (12.4)
	11	16 (5.1)
	12	42 (13.3)

Table 2. Descriptive statistics, Pearson correlations, and Cronbach's alpha of academic and individual factors and academic engagement (N = 315)

	E1	E2	E3	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
E1	1												
E2	0.55***	1											
E3	0.46***	0.50***	1										
F1	0.41***	0.32***	0.44***	1									
F2	0.44***	0.33***	0.29***	0.34***	1								
F3	0.59***	0.41***	0.43***	0.52***	0.47***	1							
F4	0.21***	0.11*	0.11*	0.24***	0.27***	0.29***	1						
F5	0.49***	0.32***	0.17**	0.13*	0.39***	0.37***	0.24***	1					
F6	0.35***	0.28***	0.12*	0.09	0.31***	0.31***	0.07	0.67***	1				
F7	0.29***	0.22***	0.13*	0.11*	0.22***	0.26***	0.19***	0.57***	0.64***	1			
F8	0.34***	0.31***	0.25***	0.18***	0.21***	0.30***	0.16**	0.60***	0.34***	0.32***	1		
F9	0.34***	0.27***	0.19***	0.24***	0.18***	0.29***	0.18***	0.62***	0.46***	0.45***	0.67***	1	
F10	0.28***	0.23***	0.22***	0.05	0.24***	0.20***	0.10	0.46***	0.34***	0.34***	0.56***	0.60***	1
Mean	18.56	20.17	29.85	26.49	25.15	21.12	26.68	94.62	13.22	12.26	21.92	24.54	19.36
SD	6.72	6.57	8.66	5.03	6.92	5.11	5.24	18.56	5.25	3.98	6.32	6.83	5.29
[Min, Max]	[2,35]	[5,40]	[0,44]	[7,35]	[8,40]	[6,30]	[7,35]	[50,154]	[5,25]	[4,20]	[8,40]	[9,45]	[7,35]
Cronbach's alpha	0.91	0.85	0.94	0.88	0.87	0.88	0.84	0.94	0.95	0.91	0.86	0.83	0.89

$^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$

E1: Emotional engagement; E2: Behavioral engagement, E3: Cognitive engagement, F1: Self-efficacy, F2: Time management, F3: Hope, F4: Support from family and friends, F5: Learning-teaching environment, F6: Servant leadership, F7: Staff-student interaction, F8: Equipment, F9: Welfare amenities, F10: Scientific and extracurricular spaces, SD: Standard deviation, Min: Minimum, Max: Maximum

Table 3. Effects of academic factors on academic engagement

	B[1]	Se[2]	Z[3]	P-Value[4]
Total	0.55	0.05	10.42	<0.001
Total indirect	0.35	0.06	6.38	<0.001
Specific indirect 1				
Academic factors → individual factors → academic engagement	0.35	0.06	6.38	<0.001
Direct				
Academic factors →academic engagement	0.20	0.06	3.16	0.002
Individual factors → academic engagement	0.74	0.06	12.84	<0.001
Academic factors → individual factors	0.49	0.06	8.83	<0.001

[1]Standardized coefficient; [2]Standard error; [3]Z-test statistics; [4]Two-tailed p-value

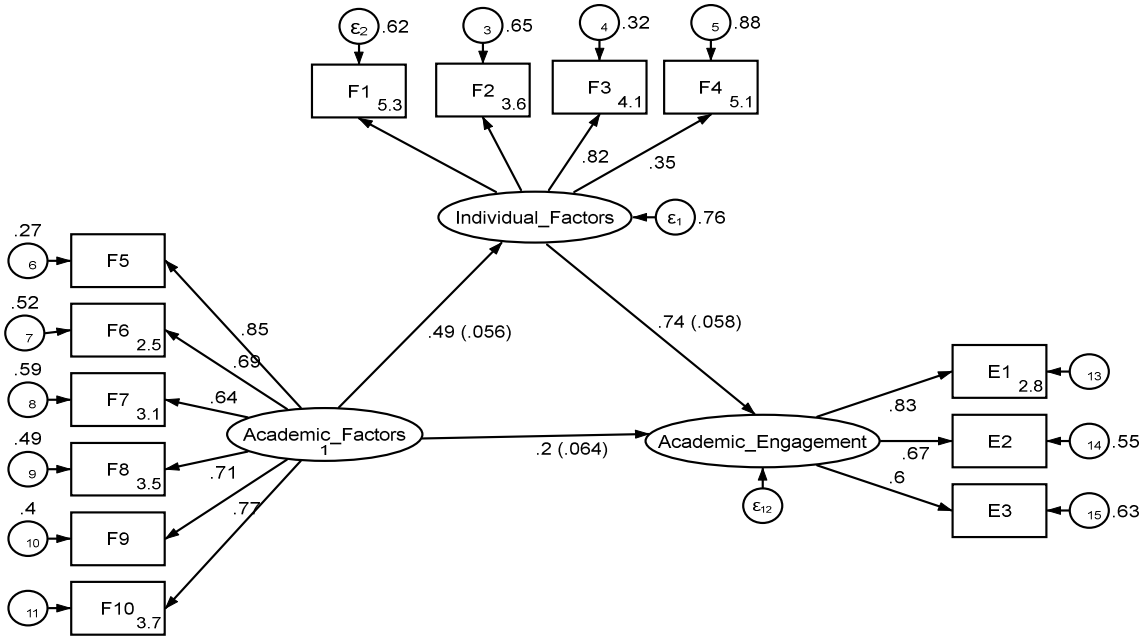

Figure 1. Structural equation modeling of academic factors and individual factors on academic engagement

E1: Emotional engagement; E2: Behavioral engagement, E3: Cognitive engagement, F1: Self-efficacy, F2: Time management, F3: Hope, F4: Support from family and friends, F5: Learning-teaching environment, F6: Servant leadership, F7: Staff-student interaction, F8: Equipment, F9: Welfare amenities, F10: Scientific and extracurricular spaces. All coefficients are significant ($P < 0.05$).

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Letter to editor

Reflection on the Applications and Obstacles of Artificial Intelligence in Medical Education

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Keywords: Artificial Intelligence; Medical Education; Applications; Obstacles

Dear Editor,

Artificial intelligence (AI), defined as machines exhibiting intelligent behavior such as observation, reasoning, learning, and communication, is a rapidly evolving field reshaping science and society. First coined by John McCarthy et al. in 1955 (1), AI has the potential to transform medical education by introducing personalized learning experiences, enhancing skill development through realistic simulations, and optimizing educational resources. This shift could make training more adaptive, efficient, and aligned with individual student needs, ultimately producing better-prepared medical professionals (2-4).

One example of generative artificial intelligence (AI) is Chat GPT, which relies on large language models (LLMs)—advanced algorithms trained on massive datasets to generate human-like text. This technology enables ChatGPT to assist in clinical teaching and classroom settings by responding to queries and providing tailored content (5). However, its use comes with limitations, such as the risk of generating inaccurate information and ethical concerns, including potential over-reliance by students and privacy issues tied to processing personal data (2, 3, 5).

Applications of AI in Medical Education Include, for Instance:

Simulation: AI produces vivid simulations of medical scenarios, enabling students to sharpen their skills in a safe, controlled setting. For example, medical trainees can work with virtual patients—designed by AI to show realistic symptoms like those of a heart attack or adjust to treatments in real-time—improving their ability to diagnose and treat without endangering real patients (2, 3). This practical training links classroom learning to clinical practice, building confidence and expertise.

Adaptive learning (Personalization): AI adjusts the curriculum to fit each student's learning pace, strengths, and gaps, delivering a tailored educational journey. By reviewing data like test scores or study duration, AI might focus on tricky areas—such as pharmacology—while moving swiftly through mastered topics like anatomy, helping students learn faster and retain more effectively (2, 3).

Assessment: AI tools offer immediate, detailed feedback on performance, going beyond basic scoring. For instance, AI might assess a student's technique after a simulated procedure, note errors like incorrect suture placement, and recommend ways to improve. This real-time advice allows learners to progressively spot weaknesses and enhance their skills (2, 3).

Virtual assistants: AI-powered assistants provide constant academic support, answering questions, explaining tough concepts, and suggesting relevant resources. A student puzzled by biochemistry could get a clear explanation of enzyme functions, a link to a

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helpful video, or custom practice questions, boosting independent study outside regular hours (2, 3).

Resource optimization: AI streamlines resource use by directing students to key materials—like case studies or articles—based on their needs while pinpointing topics like rare conditions that need more attention. For instructors, it highlights curriculum weaknesses, ensuring resources are used where they matter most (2). AI can assist in raising the standard of medical education by utilizing these skills to make it more effective, efficient, and interesting for students.

These applications promise to elevate the quality of medical education by making it more effective and student-centered, equipping future practitioners with robust, practical skills. Although AI offers great promise, its integration into medical education encounters substantial obstacles:

Educator Preparation and Skills: Many instructors lack the necessary knowledge to use AI effectively, requiring thorough training initiatives to bridge this gap (6).

Financial and Access Barriers: The development and deployment of AI systems demand significant investment, restricting their use in institutions with limited resources (2, 3).

Privacy Risks and Algorithmic Bias: AI depends on large volumes of student data, sparking confidentiality concerns, while flawed training datasets can result in biased and inequitable evaluations (2, 3).

AI in medical education cannot be successfully implemented unless these issues are resolved.

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References

1. McCarthy J, Minsky ML, Rochester N, Shannon CE. A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence. AI Magazine. 2006;27(4):12-4.
2. Varma JR, Fernando S, Ting BY, Aamir S, Sivaprakasam R. The Global Use of Artificial Intelligence in the Undergraduate Medical Curriculum: A Systematic Review. Cureus. 2023 May 30;15(5):e39701. doi: 10.7759/cureus.39701. [PMID: 37398823] [PMCID: PMC10309075]
3. Lee J, Wu AS, Li D, Kulasegaram KM. Artificial Intelligence in Undergraduate Medical Education: A Scoping Review. Acad Med. 2021 Nov 1;96(11S):S62-S70. doi: 10.1097/ACM.0000000000004291. [PMID: 34348374]
4. Keshavarzi MH, Hashemi A, Norouzi A, Ramezani G. Twelve Tips to Improve the Quality of Medical Education, the Experience of AMEE Live 2024 Conference. Strides Dev Med Educ. 2025; 22(1): e1471. doi: 10.22062/sdme.2025.200537.1471.
5. Ellis LD. 5 Ways Medical Educators Can Use AI and Other Technologies. [cited 2023 Jul 21]. Available from: https://postgraduateeducation.hms.harvard.edu/trends-medicine/5-ways-medical-educators-can-use-ai-other-technologies.
6. Pedro F, Subosa M, Rivas A, Valverde P. Artificial intelligence in education: Challenges and opportunities for sustainable development. Paris, France: UNESCO; 2019.

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Original Article

Evaluating Adoption of Learning Management Systems using the SWOT Framework: A Descriptive Qualitative Study

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Abstract

Background: While LMS has become increasingly prominent in universities, there is still limited experience with its implementation in Iran.

Objectives: This study was structured to identify the strengths, weaknesses, opportunities, and threats (within the SWOT framework) associated with implementing a national LMS across Iranian universities of medical sciences.

Methods: In this descriptive qualitative study, data were gathered through semi-structured interviews with 16 participants, including university professors, directors of e-learning units, and LMS administrators, from 11 universities. Qualitative content analysis was performed using the SWOT framework for data analysis.

Results: We extracted 21 subthemes which were arranged under seven strengths (appropriate instructional design, providing basic modules, user-friendliness, ongoing updates, fetching courses' data, reducing costs and equity in access to e-learning infrastructure), six weaknesses (limitations in the modules, the notification system and the reports; restrictions in connection with other software, being slow to load and delayed technical support), four opportunities (international commercialization, open-source provision, stakeholders' participation in LMS improvement and building an independent research and development team), as well as four threats (competitive LMS market, lack of appropriate rules and regulations, insufficient financial resources and limitations in infrastructure and facilities).

Conclusion: The findings of this study can assist higher education authorities in effectively taking economic, technical, pedagogical, legal, and interdisciplinary human resource factors into account to ensure successful implementation and continuous improvement of a new LMS.

Keywords: Iran; Universities; Computer-Assisted Instruction; Financial Stress; Software

Background

Learning management systems (LMSs) are web-based e-learning platforms which provide an environment for delivering course information, content, and learning activities, principally supporting asynchronous interaction between students and instructors (1). Universities have invested heavily in providing LMS to guarantee the enhancement of students' learning experiences in the information age (2). LMS definitions and functions revolve around teaching and learning management. Turnbull et al. (3) define LMS as online learning technologies employed to make, manage, and implement course materials. Meanwhile, evidence indicates that the ecosystem of LMSs will change and expand soon with new technologies such as the Internet of Things (4) and artificial intelligence (5). Considering the current usage and future developments, suitable policy-making is required for LMS management and administration. Most LMSs are governed by institutional policies that provide general guidelines on utilizing information and communication technology (3). Clear policies outline the proper technology infrastructures as well as contribute to developing, managing, and working with LMSs (6, 7).

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LMS adoption in developing countries has more challenges than in developed ones (8, 9). Different factors are identified as major reasons for developing countries' failure in LMS utilization including technological, organizational, and self-factors, which result in lack of user satisfaction (9). To overcome such challenges, LMS should be designed and adopted as a learning community, i.e., LMS stakeholders should consider serious participation in expanding the learning ecosystem (10).

According to (11) the Ministry of Health and Medical Education (MOHME), the authority body supervising universities of medical sciences had announced no clear policy for e-learning and educational technologies until 2013 in Iran. At that time, most of the 52 universities of medical sciences did not have any LMSs, and only a few had their own systems, which were used sparsely. One of the main agendas of this policy was to provide LMS infrastructure for universities of medical sciences. This duty was assigned to the Smart (Virtual) University of Medical Sciences. Thus, the design and creation of a national LMS, named NAVID, was initiated in 2016. Two of the authors, "Mojtahedzadeh and Mohammadi", were principal instructional designers of the project. It was made freely available to all universities of medical sciences in 2018 and some universities employed it voluntarily. With the outbreak of the COVID-19 pandemic, all universities of medical sciences adopted NAVID LMS (12).

After about 5 years of using NAVID LMS as a national platform, many studies have addressed NAVID as the medium for their teaching-learning processes across different universities (12-17), indicating its popularity. Indeed, although the availability of the NAVID LMS as a national infrastructure was identified as an opportunity for depicting the strategic direction of medical sciences education (18), a few studies have focused on evaluating the LMS itself from different perspectives (19). Accordingly, this study aimed to explore the strengths, weaknesses, opportunities, and threats (i.e., within the SWOT framework) of this experience. We believe that the results of this study will assist authorities of higher education institutions, especially those in developing regions confronting similar budgetary and resource challenges, in understanding the benefits and limitations of this experience.

Objectives

This study was structured to identify the strengths, weaknesses, opportunities, and threats (within the SWOT framework) associated with implementing a national LMS across Iranian universities of medical sciences.

Methods

Study Design: We applied a descriptive qualitative research method to explore participants' lived experiences and perceptions of the NAVID LMS. Sandelowski (20) emphasized that in descriptive qualitative research, a shared understanding of a phenomenon is developed by examining participants' experiences, facilitating discovery. Whereas much of this process focuses on detailed description, interpretation is applied selectively when necessary. Meanwhile, a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis is one of the effective situation analysis techniques organizations utilize to provide in-depth information on their position according to the internal and external environmental elements (21). Strengths and weaknesses refer to the organizational internal elements that facilitate or interfere with goal achievement; on the other hand, opportunities and threats address the external ones. This analysis is widely employed in different fields including education (22).

Participants and Setting: Data were collected through semi-structured interviews with 16 participants who were actively involved in utilizing and adopting the NAVID LMS. The sample selection was based on three key indicators: i) active professors specializing in e-learning and users of NAVID, ii) managers of Medical Education Development Centers (MEDCs) responsible for facilitating e-learning, and iii) technical experts from MEDCs who served as NAVID administrators. The participants took part from 11 universities of varying sizes across the country. Table 1 reports the demographic characteristics of the participants. We selected the participants through a purposeful sampling method, following the principle of maximum diversity, and continued the sampling process until reaching qualitative data saturation in each participant group (23) based on their stance about LMS adoption.

Table 1. Demographic Characteristics of the Study Participants

Variable	Type	N (%)
Gender	Male	7 (43.75)
	Female	9 (56.25)
Degree level	Master of Science	4 (25)
	Doctor of Philosophy (Ph.D.) or clinical specialist	12 (75)
Position	Professors with e-learning experiences	6 (37.5)
	Directors of e-learning units/offices	6 (37.5)
	LMS admins	4 (25)

Conducting Semi-Structured Interviews: We conducted semi-structured interviews for data collection. The interview probing questions were as follows:

- What strengths do you think NAVID LMS has?
- Has it succeeded in achieving the intended goals as a national LMS?
- What weaknesses do you think NAVID LMS has?
- Are the services provided by NAVID LMS aligned with the needs, conditions, and facilities of your university?
- What are the opportunities for the further development of NAVID LMS?
- What are the threats interfering with the further development of NAVID LMS?
- What are the benefits and limitations of the national design as well as provision of NAVID LMS in a developing country like Iran?

Further, more detailed questions were asked, if necessary. The interviews lasted between 30 to 90 minutes. All interviews were audio recorded and transcribed verbatim.

Content Analysis of the Interview Transcripts: We employed directed content analysis, where the SWOT analysis framework serves as the initial structure to collect and categorize data (24). We thoroughly reviewed and systematically coded the transcripts using Microsoft Word 2016. We then returned the transcript and extracted codes of each interview to the related interviewee to check for accuracy and final feedback.

We utilized some strategies indicated by Creswell and Poth (25) to ensure the validity and reliability of the findings:

Triangulation: We collected data from multiple sources, including university professors with e-learning experience, directors of e-learning units, and LMS admins, to capture all main stakeholders' views.

- Member checking: To eliminate the researchers' bias and bring the findings closer to reality, the transcripts and extracted codes were returned to the interviewees to guarantee the credibility of the results.
- Rich and thick description: We described the study setting, participants' characteristics, data collection and coding processes, as well as the results in detail to ensure the transferability of the findings.
- Prolonged engagement: The interviewer developed mutual trust and built rapport with the interviewees. Further, we took ample time to engage with the data and thoroughly read the transcripts, allowing us to gain a profound understanding of both the transcripts and the coding.
- Intercoder reliability: Two researchers analyzed the transcribed data independently to extract codes and then checked the final results to reach an agreement on the codes, subthemes, and assigned themes.

Results

Through the content analysis of the data, we extracted 235 codes, which were classified into 21 subthemes and arranged under four predetermined themes: i) strengths, ii) weaknesses, iii) opportunities, and iv) threats of NAVID LMS adoption. These subthemes were 7 strengths, 6 weaknesses, 4 opportunities, and 4 threats (Table 2).

Herein, we further elaborate on each subtheme with participants' illustrative comments.

NAVID strengths

Appropriate instructional design: According to the participants, NAVID LMS had an appropriate instructional design following the educational principles and international experiences. Adequate modules, suitable configuration, appropriate fonts and colors, graphic appeal, English-Persian views, and balanced cognitive load were other positive points mentioned for NAVID LMS. For example, one of the e-learning office directors stated:

NAVID benefits from an appropriate instructional design. I think performing the instructional design process for an educational platform based on the experiences and interests of the users would make a lot of difference in its usage (Participant No. 8).

Providing basic modules for e-teaching: Some participants emphasized that NAVID covers basic users' needs through the possibility of uploading different types of content; interacting with students by using assignments, forums, and messaging modules; grading; generating reports, and creating exams. In this regard, Participant No. 2 who was a medical education professor stated:

Even though NAVID lacks numerous features, it is popular because university professors often do not require many modules and may even prefer straightforward platforms with sufficient functionality. Fortunately, NAVID meets the bare essentials of an acceptable LMS.

User-friendliness: Many participants indicated that users do not require extensive training to log in and use NAVID, though training videos were available. In this regard, one of the university professors stated:

NAVID LMS is convenient and user-friendly.

Table 2. Themes, Subthemes, and Their Frequency Mentioned by Interviewees about NAVID LMS within the SWOT Framework

Themes	Sub-themes	Frequency
Strengths	Appropriate instructional design	11
	Providing basic modules for e-teaching	4
	User-friendliness	8
	Ongoing updates	4
	Fetching data from the Student Administrative Software	6
	Reducing e-learning costs	6
	Equity in access to e-learning infrastructure	5
Weaknesses	Limitations in the modules	10
	Limitations in the notification system	5
	Limitations in the reports	3
	Restrictions in connection with other software	5
	Being slow to load	5
	Delayed technical support	4
Opportunities	International commercialization	3
	Making NAVID LMS an open-source software	4
	Stakeholders' participation in LMS improvement	8
	Building an independent research and development team	5
Threats	The highly competitive LMS market	5
	Lack of appropriate rules and regulations for e-learning	13
	Insufficient financial resources	8
	Limitations in technological infrastructure and facilities	9

It indicates where NAVID modules are located and how they function, which is crucial in determining software usage (Participant No. 6).

Ongoing updates: Interviewees believed that the NAVID team had made efforts in several cases such as fixing bugs, improving the existing modules, and adding new ones such as the content repository module. For instance, one of the professors expressed his experience of NAVID development as follows:

NAVID LMS has significantly improved compared to the first versions. Continuous software updates show the users that a dedicated team supports it (Participant No. 6).

Fetching data from the Student Administrative Software (SAS): Along the interviews, each university NAVID was connected to its SAS through an automatic web service for fetching the data of courses along with their students and teachers. This was identified as a primary factor in NAVID's widespread usage. In this regard, one of the NAVID admins stated:

Automated fetching of the courses' data and participants is the most pragmatic approach making an LMS accessible for each teacher. Professors were amazed when they logged in to LMS and could have access to their students as well as courses at the first instance (Participant No. 14).

Reducing e-learning costs: The participants noted that many universities lacked the budget to implement an LMS prior to launching NAVID. Some interviewees highlighted the government's role in providing free LMS, which was essential for e-learning dissemination in Iran during and before the pandemic. One of the e-learning experts from a middle-sized university mentioned:

For a developing country like Iran with serious budget constraints, if every university provides an LMS for itself, it will increase the costs of the system in public universities that rely on governmental budgets (Participant No. 1).

Equity in access to e-learning infrastructure: According to some participants, NAVID LMS ameliorated the educational equity in access to e-learning infrastructure in universities of medical sciences. It helped during the COVID-19 pandemic and prevented the closure of education, especially in underprivileged universities. One of the directors of the e-learning offices outlined:

When a facility such as LMS is provided, some professors become willing to use it. Meanwhile, the COVID-19 pandemic made it a necessity to do so. NAVID was an equal opportunity for professors and

students, especially in smaller and newly established universities (Participant No. 9).

NAVID weaknesses

Limitations in the modules: The participants addressed some weaknesses for both content delivery and interactive NAVID modules technically (such as limitations in file size upload) and pedagogically (such as the need to group students for assigning different contents or assignments). The NAVID exam module was stated as its most problematic feature not being competitive with other LMSs. The participants emphasized that NAVID should either be linked to specialized electronic exam software, or its exam module requires significant development.

Limitation in the notification system: NAVID did not have an appropriate notification system such as emailing or messaging as described by many participants, one of whom noted:

One of the few advantages of our previous LMS compared to NAVID was sending notification emails for activities. NAVID lacks this feature, requiring users to check their dashboards regularly to avoid missing any activity (Participant No. 6).

Limitations in the reports: Some interviewees stated that although NAVID reports for student activities were complete, they lacked enough data for teachers' activities, especially for the courses delivered by several teachers. One of the NAVID admins stated that:

Authorities of universities need detailed reports of teachers' activities for evaluation purposes. An LMS should support such a need, especially in the courses delivered by several teachers (Participant No. 13).

Restrictions in connection with other software: Although each university's NAVID was connected to its SAS, the participants noted the necessity of NAVID being linked to other university software such as electronic exam system, online class platforms, and teacher evaluation software, as stated by one of the e-learning office directors:

I understand that every university uses its own electronic exam or online class software, making it difficult for the NAVID team to plan for such personalized connections for each university; meanwhile, this is a crucial function (Participant No. 10).

Being slow to load: This limitation was indicated by the LMS admins, especially when they had to fetch data from SAS or get reports.

Delayed technical support: Some participants believed that the technical support team was slow in resolving bugs and errors. One of the interviewees expressed his concern as follows:

It is disappointing for students and professors to face bugs and errors while working with the LMS, and this worsens when it takes time to resolve (Participant No. 3).

NAVID opportunities

International commercialization: The participants believed that NAVID had the potential to be introduced to the LMS international market as a commercial low-cost LMS suitable for low-income institutions in the region. In this regard, one of the participants noted:

"International commercialization of NAVID LMS is not out of reach if only the team improves in technical and support aspects" (Participant No. 13).

Making NAVID LMS an open-source software: Some interviewees suggested making NAVID an open-source software to benefit from collaborative development with the help of software experts to improve the current modules and add new ones. In this regard, an interviewee asserted:

Considering the budget constraints for expanding the NAVID team, making it an open-source software may be a reasonable solution for enhancing the modules and creating new features as well as add-ons such as an e-portfolio or a better exam tool (Participant No. 8).

Stakeholders' participation in LMS improvement: Several participants focused on the national reputation of NAVID as an opportunity to invite users and experts from the LMS industry to criticize NAVID from both technical and pedagogical aspects. In this regard, an e-learning office director mentioned his idea for the development of NAVID as follows:

NAVID team should organize a software bug-finding contest and invite different people including software programming experts, active users, and professionals to find its bugs or suggest new ideas for better performance (Participant No. 10).

Building an independent research and development team: The participants had the idea of virtually gathering an interdisciplinary team, other than the one involved in NAVID implementation and maintenance to conduct ongoing needs assessments and visualize the future for NAVID LMS. For example, one of the participants stated:

Research and development of such a nationally utilized LMS needs an independent team, not involved in its maintenance and support. This team can contribute virtually and should consist of expert e-learning instructional designers, who understand the principles of computer science, along with software

technical members, who are aware of the basics of virtual learning pedagogy (Participant No. 13).

NAVID threats

The highly competitive LMS market: According to some participants, the closure of universities during the COVID-19 pandemic resulted in a significant investment in the private sector for developing new LMSs or customizing open-source ones such as Moodle. Some highlighted that NAVID should be a dynamic software with ongoing improvement to survive in such a competitive market.

Lack of appropriate rules and regulations for e-learning: The participants criticized the lack of up-to-date and clear strategies for e-learning along with its application in biomedical programs at both national and university levels. They were concerned about the continuation of adopting e-learning or blended learning after the pandemic, which would hinder NAVID usage. One of the e-learning office directors describes this concern as follows:

Unfortunately, following the COVID-19 pandemic and universities' re-openness, we do not have clear rules and regulations for continuing the appropriate implementation of blended or e-learning strategies in face-to-face programs. We should have a clear plan to benefit from the provided infrastructure and professors' experiences of using them (Participant No. 8).

Insufficient financial resources: Most participants indicated that NAVID LMS did not have sufficient financial support for development and maintenance. For instance, one of the e-learning office directors of a large university stated:

Authorities and policymakers should be aware that if NAVID LMS is not supported financially, it will disappear in competition with other LMSs. Then, small and medium-sized universities with serious budget constraints cannot afford to provide another LMS, which means not using e-learning at all (Participant No. 8).

Limitations in technological infrastructure and facilities: According to some participants, the shortage of hardware infrastructure posed a significant threat to NAVID software. Many university managers and users addressed issues such as NAVID had hardware limitations.

Discussion

In this study, we explored the nationally developed and implemented NAVID LMS' strengths, weaknesses, opportunities, and threats by conducting semi-structured interviews with the stakeholders and performing content analysis of the interviews within the SWOT framework.

We identified seven points of strength for NAVID LMS, including appropriate instructional design, providing basic modules for e-teaching, user-friendliness, ongoing updates, fetching data from SAS, reducing e-learning costs, and providing equity in access to e-learning infrastructure. Some studies have highlighted the attention and significance of instructional design for LMS creation along with its important role in users' satisfaction. The proper design of LMS motivates learners to study (26). Accordingly, the most frequently noted strength was its effective instructional design. This may be due to consideration of educational principles in addition to the users' characteristics and interests as well as paying attention to the good configuration and graphics creating an environment with a low cognitive load.

The participants believed that NAVID provided basic modules for e-teaching in accordance with some studies conducted using NAVID LMS (12, 15). Working with these NAVID modules was reported to be simple and convenient, as confirmed by another study (19). LMS user-friendliness is associated with better students' perceived usefulness (27) as well as greater satisfaction with the tool (28) and an indicator of its easier adoption (29, 30). Monitoring and updating of the NAVID LMS has been stated to be one of the challenges faced in the delivery and maintenance stages of implementing e-learning (31).

Perceived usefulness and user satisfaction significantly influence adoption rates of digital tools, serving as key indicators of successful adoption (27, 28). Furthermore, maintaining and updating e-learning platforms emerges as a persistent challenge throughout both in the delivery and maintenance stages of implementing e-learning (29). Although the participants lacked extensive experience with the quality of international LMS, they acknowledged that the NAVID LMS team effectively updated the software based on their feedback. Similarly, prior research has affirmed that continuous improvement, regular updates, and the expansion of LMS functions as well as services for users in higher education institutions are among the primary goals of successful LMS implementation (6).

Further, Uziak et al. (32) stated that in their experience no connection was established between their university SAS and the pioneer Blackboard LMS, which was a serious problem. NAVID LMS team technically handled this concern by providing each university NAVID admin with the integration of data of all courses

with their instructors and students from each university's SAS into NAVID along with users' authentication service at the beginning of each semester. In addition, based on our findings, reducing educational costs and enhancing equity in access to educational resources have been mentioned as benefits of using LMSs (28, 33).

In spite of the above-mentioned strengths, six items were extracted for NAVID LMS weaknesses, including limitations in the modules, the notification system, and the reports; restrictions in connection with other software; slow loading and delayed technical support. Some of the limitations in NAVID modules can be categorized as adding further features and specifications into the LMS. Meanwhile, the adoption of numerous specifications makes an LMS complex and prohibits the users' acceptance (34). NAVID's simple instructional design contributed to its widespread adoption.

In addition to university SAS, NAVID LMS was connected to some university Adobe Connect systems for holding synchronous sessions, which was a good experience (19). Such integrations to related software such as virtual classes and electronic exams are among the criteria for adopting an LMS and provide better usage of e-learning facilities for users (35).

Slow loading, as the next point of weakness for NAVID LMS, may be caused by some factors. It can be related to the student and faculty members' Internet connection limitations (27, 29, 36). It can also be the consequence of hardware or software issues. As reported by other researchers, the COVID-19 pandemic urged an extreme load on servers that hosted LMSs and many users began to utilize these systems (37). This caused slowness and technical delays in working with the NAVID LMS, particularly at the beginning of the COVID-19 outbreak. Finally, the last mentioned weakness for NAVID LMS was delayed technical support of users. Accountable and fast technical support service has been stated to be one of the main success factors of LMS implementation in other experiences for other LMSs as well (28, 29, 32, 36). In addition, another study specifically on NAVID implementation addressed the same issue (14).

In addition to the internal factors, the participants stated some opportunities for NAVID LMS in the external environment including international commercialization, making NAVID LMS an open-source software, stakeholders' participation in LMS improvement, as well as building an independent research and development team. Regarding the chance of international commercialization of NAVID LMS, we assume that the multi-lingual architecture of the software along with its user-friendliness and some good features provide such an opportunity. Meanwhile, the software coding structure could be revised to move towards open coding. Thus, there is a need for a clear policy on its commercialization or open-source delivery. If the open-source model is followed, service-based business models should be adopted instead of traditional license-based ones (38).

Stakeholders' participation in recognizing the bugs and improving the modules, as another opportunity, allows for receiving ideas in various ways, such as inviting experts from the LMS industry or asking for users' participation for its improvement. Moodle LMS bug tracker is a good example of such an opportunity through which developers, experts, and ordinary users contribute to reporting the bugs and improving the software (39). Ultimately, forming a research and development team with an interdisciplinary academic background and observing issues from different angles constituted another opportunity which could keep LMS developers close to emerging technical and scientific developments. The importance of such teams and the benefit of their virtual development for software projects have been recommended in the literature (40).

The threats of NAVID LMS revolve around economical, structural, and digital infrastructure components. The first threat was the competitiveness of the LMS market in Iran and the activity of private companies, which have increased since the COVID-19 pandemic. This competition has also been mentioned for well-known learning management systems (LMSs) such as Blackboard (41). Out-of-date as well as insufficient rules and regulations related to e-learning dissemination at the governmental level have been noted as another threat to NAVID LMS usage. This challenge of legal legitimacy in the Iranian higher education context has been stated in another study (42). Thus, authorities should develop and legitimize effective policies as well as regulations focused on post-Covid conditions. The lack of financial resources to maintain and expand e-learning is another threat that has limited the work on emerging and advanced technologies. The challenge of affording hardware and software costs of e-learning is also a concern in other contexts (43). This needs a thorough investigation of the cost-effectiveness of any action before its adoption. Eventually, the participants stated that the technological infrastructure of e-learning in universities was insufficient and had

raised obstacles to using e-learning. This limitation is aligned with other experiences and warrants a more accurate examination of the prerequisites of LMS adoption (44).

Limitations: Despite the research team's efforts to conduct a SWOT analysis of the NAVID LMS, the lack of participation from senior managers and policymakers of the MOHME, as well as administrators of other active e-learning LMS across the country, stands out as a major shortcoming of this study. The participation of these stakeholders could have greatly enhanced the findings by allowing for a deeper analysis the external opportunities and threats.

Conclusion

The results highlighted internal and external factors essential for developing strategies to enhance strengths, address weaknesses, leverage opportunities, and mitigate threats in adopting and maintaining an LMS, particularly the NAVID LMS. According to these findings, several key suggestions should be considered to improve the quality of the NAVID LMS. Firstly, strengthening support and design teams through an interdisciplinary approach will help eliminate bugs and ameliorate the system quality based on audience's needs and evolving technological advancements. Further, the communication between users and the support team can be facilitated by launching an interactive website and developing mobile-friendly applications, ensuring greater accessibility and responsiveness. Transitioning from a closed-source approach to an open-source model will enable experienced experts to contribute to system improvements, leveraging collective knowledge and expertise. In addition, integrating Navid with essential domestic and international platforms will enhance teaching quality and optimize the management of the learning process. Ultimately, ensuring continuous financial investment is crucial for regular updates and upgrades, maintaining the system's effectiveness and long-term sustainability.

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References

1. Raza SA, Qazi W, Khan KA, Salam J. Social isolation and acceptance of the learning management system (LMS) in the time of COVID-19 pandemic: an expansion of the UTAUT model. Journal of Educational Computing Research. 2021 Apr;59(2):183–208. doi: 10.1177/0735633120960421. [PMCID: PMC7509242]
2. Dlalisa SF, Govender DW. Challenges of acceptance and usage of a Learning Management System amongst academics. International Journal of eBusiness and eGovernment Studies. 2020;12(1):63-78. doi:10.34111/ijebeg.202012105.
3. Turnbull D, Chugh R, Luck J. Learning Management Systems: an overview. In: Tatnall A, editor. Encyclopedia of Education and Information Technologies. Cham: Springer International Pub; 2020. doi:10.1007/978-3-030-10576-1_248.
4. Mershad K, Wakim P. Learning management system enhanced with Internet of things applications. Journal of Education and Learning. 2018;7(3):23-40. doi:10.5539/jel.v7n3p23.
5. Zawacki-Richter O, Marín VI, Bond M, Gouverneur F. Systematic review of research on artificial intelligence applications in higher education—where are the educators? International Journal of Educational Technology in Higher Education. 2019;16(1):1-27. doi:10.1186/s41239-019-0171-0.
6. Alduraywish Y, Patsavellas J, Salonitis K. Critical success factors for improving learning management systems diffusion in KSA HEIs: An ISM approach. Education and Information Technologies. 2022;27(1):1105-31. doi:10.1007/s10639-021-10621-0.
7. Iqbal S. Learning management systems (LMS): Inside matters. Information Management and Business Review. 2011;3(4): 206–216. doi:10.22610/imbr.v3i4.935.
8. Aljarrah AA, Ababneh MAK, Cavus N. The role of massive open online courses during the COVID-19 era: Challenges and perspective. New Trends and Issues Proceedings on Humanities and Social Sciences. 2020; 7(3): 142-52. doi: 10.18844/prosoc.v7i3.5244.
9. Alshammari SH, Ali MB, Rosli MS. The influences of technical support, self-efficacy and instructional design on the usage and acceptance of LMS: A comprehensive review. Turkish Online Journal of Educational Technology-TOJET. 2016;15(2):116–25. doi: 10.17718/tojde.762034.
10. Kwon S, Kim W, Bae C, Cho M, Lee S, Dreamson N. The identity changes in online learning and teaching: instructors, learners, and learning management systems. Int J Educ Technol High Educ. 2021;18(1):67. doi: 10.1186/s41239-021-00304-8. [PMID: 34977335] [PMCID: PMC8712100]
11. Ostad SN, Ahmady S, Mohammadi A, Sabzevari O, Mojtahedzadeh R, Razavizadeh M, et al. Evolution of e-learning in Iran's medical sciences universities: Formation of Virtual University of Medical Sciences. Teb va Tazkiye. 2019;27(4): 233-43. [In Persian]
12. Houshmandi S, Rezaei E, Hatami J, Molaei B. E-learning readiness among faculty members of medical sciences universities and strategies for improvement. Research and Development in Medical Education. 2019; 8(2): 105-12. doi: 10.15171/rdme.2019.020.
13. Abedi P, Iranmanesh F, Bagheri SHS, Rafiei M, Afshari H. Virtual medical education during the COVID-19 pandemic in Iran: A qualitative study of perspectives on challenges and strategies. Journal of Medical Education for Future Demands. 2021;20(4): e121204. doi:10.5812/jme.121204.
14. Dargahi H, Kooshkebaghi M, Mireshghollah M. Learner satisfaction with synchronous and asynchronous virtual learning systems during the COVID-19 pandemic in Tehran University of

Medical Sciences: A comparative analysis. BMC Med Educ. 2023 Nov 21;23(1):886. doi: 10.1186/s12909-023-04872-3. [PMID: 37990188] [PMCID: PMC10661977]
15. Hashemikamangar SS, Gholampourdehaki M. A team-based e-learning method for clinical education in the COVID-19 pandemic. Ann Mil Health Sci Res.2021;19(3):e115409. doi:10.5812/amh.115409.
16. Hengami MH, Faridi F, Kamali F. Monitoring and evaluating quality of e-learning in basic sciences section and introduction to clinical medicine section in the school of medicine during COVID-19 pandemic. Acta Medica Iranica. 2022;60(8):526-31. doi:10.18502/acta.v60i8.10839.
17. Shakour M, Shamsi M, Bazrafkan L. Designing, implementing, and evaluating an introductory course on virtual learning in the COVID-19 pandemic era. Journal of Medical Education Development. 2022;15(47):55-61. doi: 10.52547/edcj.15.47.55.
18. Karimian Z, Farrokhi MR, Moghadami M, Zarifsanaiey N, Mehrabi M, Khojasteh L, et al. Medical education and COVID-19 pandemic: a crisis management model towards an evolutionary pathway. Educ Inf Technol (Dordr). 2022;27(3):3299-3320. doi: 10.1007/s10639-021-10697-8. [PMID: 34566468] [PMCID: PMC8450917]
19. Ebadi S, Khazaie S, Bashiri S. Technology acceptance of NAVID learning management system in the Iranian medical English courses under the COVID-19 pandemic. Journal of English Language Teaching and Learning. 2020;12(26):401-33.
20. Sandelowski M. Whatever happened to qualitative description? Res Nurs Health. 2000 Aug;23(4):334-40. doi: 10.1002/1098-240x(200008)23:4<334::aid-nur9>3.0.co;2-g. [PMID: 10940958]
21. Benzaghta MA, Elwalda A, Mousa M, Erkan I, Rahman M. SWOT analysis applications: An integrative literature review. Journal of Global Business Insights. 2021;6(1):55-72. doi:10.5038/2640-6489.6.1.1148.
22. Gürel E, Tat M. SWOT analysis: a theoretical review. The Journal of International Social Research. 2017; 10(51): 994-1006. doi:10.17719/jisr.2017.1832.
23. Hennink MM, Kaiser BN, Marconi VC. Code saturation versus meaning saturation: how many interviews are enough? Qual Health Res. 2017 Mar; 27(4): 591-608. doi: 10.1177/1049732316665344. [PMID: 27670770] [PMCID: PMC9359070]
24. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res. 2005 Nov;15(9):1277-88. doi: 10.1177/1049732305276687. [PMID: 16204405]
25. Creswell JW, Poth CN. Qualitative inquiry and research design: Choosing among five approaches. Thousand Oaks: Sage; 2016.
26. Chanprasitchai O, Khlaisang J. Inquiry-based learning for a virtual learning community to enhance problem-solving ability of applied Thai traditional medicine students. Turkish Online Journal of Educational Technology-TOJET. 2016;15(4):77-87.
27. Alturki U, Aldraiweesh A. Application of learning management system (LMS) during the COVID-19 pandemic: A sustainable acceptance model of the expansion technology approach. Sustainability. 2021;13(19):10991. doi:10.3390/su131910991.
28. Furqon M, Sinaga P, Liliasari L, Riza LS. The impact of learning management system (LMS) usage on students. TEM Journal. 2023;12(2): 1082-9. doi:10.18421/TEM122-54.
29. Hightower TE, Murphrey TP, Coppernoll SM, Jahedkar J, Dooley KE. An examination of the strengths, weaknesses, opportunities, and threats associated with the adoption of Moodle™ by eXtension. The Journal of Extension. 2011; 49(6): 19. doi:10.34068/joe.49.06.19.
30. Owusu-Ansah S. SWOT analysis of e-learning platform, Sakai: Users' perspective. (Dissertation). Legon, Ghana: University of Ghana; 2019.
31. Okhovati M, Sharifpoor E, Karami Robati F, Oghabian Z, Namdar L. Usability Evaluation of Electronic Learning Management Systems in the University of Medical Sciences. Strides Dev Med Educ. 2024; 21(1): 179-88. doi: 10.22062/sdme.2024.199565.1349.
32. Uziak J, Oladiran MT, Lorencowicz E, Becker K. Students' and instructor's perspective on the use of Blackboard platform for delivering an engineering course. Electronic Journal of e-Learning. 2018;16(1):1-15. doi:10.34190/ejel.16.1.2367.
33. Kasim NNM, Khalid F. Choosing the right learning management system (LMS) for the higher education institution context: A systematic review. International Journal of Emerging Technologies in Learning. 2016; 11(6): 55. doi: 10.3991/ijet.v11i06.5644.
34. Mastoras T, Fotaris P, Politis A, Manitsaris A. Designing simplicity: Usability perspectives on learning management systems. WSEAS Transactions on Information Science and Applications. 2005;2(10):1731-8.
35. Dampson DG, Addai-Mununkum R, Apau SK, Bentil J. COVID-19 and online learning: A SWOT analysis of users' perspectives on the learning management system of the University of Education, Winneba, Ghana. International Journal of Learning, Teaching and Educational Research. 2020; 19(9): 382-401. doi: 10.26803/ijlter.19.9.20.
36. Bao W. COVID-19 and online teaching in higher education: A case study of Peking University. Hum Behav Emerg Technol. 2020 Apr;2(2):113-115. doi: 10.1002/hbe2.191. [PMID: 32510042] [PMCID: PMC7262082]
37. Hauge Ø, Ayala C, Conradi R. Adoption of open-source software in software-intensive organizations—A systematic literature review. Information and Software Technology. 2010;52(11): 1133-54. doi:10.1016/j.infsof.2010.05.008.
38. Costello E, Johnston K, Wade V. Crowded house: an analysis of how the Virtual Learning Environment Moodle is built via bug tracker participants. Interactive Learning Environments. 2019;31(5):2583-93. doi:10.1080/10494820.2019.1678488.
39. Ale Ebrahim N. Virtual R&D teams: A new model for product development. International Journal of Innovation. 2015;3(2): 1-27. doi:10.5585/iji.v3i2.43.
40. Ippakayala VK, El-Ocla H. OLMS: Online learning management system for e-learning. World Journal on Educational Technology: Current Issues. 2017;9(3):130-8. doi:10.18844/wjet.v6i3.1973.
41. O'Leonard K, Bersin J. Learning management systems 2006: Facts, practical analysis, trends and vendor profiles. Oakland (CA): Bersin & Associates; 2006.
42. Abbasi Kasani H, Shams Mourkani G, Seraji F, Rezaeizadeh M, Abedi H. E-learning challenges in Iran: A research synthesis. International Review of Research in Open and Distributed Learning. 2020;21(4):96-116. doi:10.19173/irrodl.v21i4.4677.
43. Walsh K. Cost and value in e-learning: the perspective of the learner. BMJ Simul Technol Enhanc Learn. 2018 Oct 4;4(4): 201-202. doi: 10.1136/bmjstel-2017-000239. [PMID: 35519015] [PMCID: PMC8936856]
44. Ilyas M, Kadir KA, Adnan Z. Demystifying the learning management system (LMS): Journey from e-learning to the strategic role. European Journal of Business and Management. 2017;9(9):12-8.

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Original Article

Evaluating Phase 2 MBBS Students' Perceptions of the Effectiveness of the Fish bowl Technique Combined with Lecture in Pathology

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Abstract

Background: Traditional classroom lecture has been the backbone of medical education for a long time. Though effective, it has inherent problems of active student engagement and facilitation of learning for better outcomes. In contrast, innovative small-group learning methods like the Fish bowl technique promote active participation and foster learning.

Objectives: The study aims to analyze the combined utility of the Fish bowl technique along with lecture and to compare students' perceptions of its effectiveness.

Methods: A quasi-experimental crossover study was conducted among second-phase medical undergraduate students in the Department of Pathology. The students were primed about the topic via a didactic lecture which was followed by a pre-test. The study consisted of 138 students, who were divided into six groups across 2 days/week (three batches/day), each group consisted of 23 students, and a Fish bowl discussion was conducted. At the end of the session, a post-test was done and feedback was taken from students.

Results: There was statistical improvement in post-test scores of the Fish bowl technique, a gain of 16.81% as compared to the pre-test score. Lecture followed by Fish bowl sessions stimulated more interest (75.36%), increased active participation (86.23%), and improved satisfaction of learning (73.91%) amongst students as compared to lecture only. The retention of the study subject, coverage of important concepts, and meaningful discussion was better with lecture along with Fish bowl discussion.

Conclusion: The combination of traditional and Fish bowl technique proved to be a positive learning experience for students. Fish bowl is an effective student-centric method that piques curiosity, promotes active participation, and fosters critical thinking.

Keywords: Medical Education; Fish bowl Technique; Lecture; Learning Experience

Background

Medical education has evolved significantly from conventional classroom instruction, focused on a chalkboard, to incorporate several Information and Communication Technology (ICT)-enabled tools and methodologies (1). A tremendous transformation in medical education has been observed, especially in recent years, which has caused medical educators to reassess standard teaching practices and develop innovative strategies to optimise student learning (2, 3). With the introduction of Competency-Based Medical Education, it is imperative for medical colleges to adopt a teaching-learning strategy to facilitate a two-way process of sharing ideas and concepts (4). In a study, Irby (5) emphasised the significance of both teaching and learning, highlighting the need to create an

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environment that fosters effective and efficient learning—an expectation that has now become the norm. Consequently, teachers are required to be experts in their fields and possess a crucial understanding of the learning process (3-5). The educational approach ought to advance from familiar to unfamiliar and from simpler concepts to more complex ones, ensuring a comprehensive and structured learning process (5).

Traditional didactic learning, the most prevalent teaching method in the medical curriculum, has major limitations, being teacher-centric, and often results in reduced student attentiveness with no scope for active learning (4). Medical educationists from around the world have created various teaching-learning methods such as seminars, small-group teaching, tutorials, and brainstorming (6).

According to the Tennessee Student/Teacher Achievement Ratio project, numerous advantages exist for both teachers and students when class sizes are smaller (7). Coles (8) and Ratnakar et al. (9) propose that student satisfaction is higher with smaller class sizes, as they allow teachers to manage students effectively, provide more individualised attention, and foster increased interaction between teachers and students. One such small classroom teaching method is the "Fish bowl" strategy, which encourages students' participation (10). The Fish bowl technique, initially used by multinational companies to enhance employee participation, is now being utilised in medical education for students, wherein there are two groups: an inner group discussing an issue or topic while the outer group listens, looking for themes, patterns, or soundness of argument, or using a group behaviour checklist to give feedback to the group on its functioning, and the role can be reversed (4, 11, 12). This innovative teaching-learning method enhances learning through increased interaction and peer evaluation. Introverted students can develop group dynamics, enhance their social skills, improve focus, and transition from passive disinterest to active, experiential learning (4).

Although several studies highlighted the advantages of innovative teaching approaches in medical education, further research is required to expand and validate these findings. Pavani et al. (10) reported that a combination of lectures and the Fish bowl technique enhanced student satisfaction. Rabbani et al. (6) emphasized that Fish bowl activities foster critical thinking, curiosity, and learner engagement. Similarly, Anand et al. (4) highlighted that the Fish bowl technique promotes the early identification of knowledge gaps, encourages self-directed learning, and facilitates holistic problem-solving. In contrast to these prior studies, the current study used a quasi-experimental crossover design, incorporated validated pre- and post-test assessments, and systematically analysed structured student feedback, specifically focusing on the application of the Fish bowl technique in pathology. The aim of this study was to evaluate the combined effectiveness of the Fish bowl technique and lectures and to compare students' perceptions of the effectiveness of the technique.

Objectives

The study aims to analyze the combined utility of the Fish bowl technique along with lecture and to compare students' perceptions of its effectiveness.

Methods

Type of study and its stages: This quasi-experimental crossover study was conducted among second-phase undergraduate medical students in the Department of Pathology. The study protocol was reviewed and approved by the institutional ethics committee (reference number: JGMMMCIEC/030/2023). The students were primed on the topic via a didactic lecture that lasted approximately 60 min before conducting the practical sessions. The Fish bowl technique, which involves structured discussions in the inner and outer circles, was used as an active learning strategy. A faculty member supervised each session, and plenary sessions were held after each discussion to consolidate the key learning points.

Study sample: A total of 138 Phase II undergraduate medical students participated in this study. Students who were present on the day of the activity and who provided informed consent were included in the study. Students who were on leave due to illness or personal reasons during the didactic lecture or Fish bowl discussion, or those who did not consent to participate, were excluded from the study. Using Minitab Statistical Software (version 16), the minimum sample size was calculated to be 64, based on an alpha of 0.05, a power of 0.8, a standard deviation of paired differences of 1.4, and a mean difference of 0.5. The purpose and protocol of the study were explained to the participants, and written informed consent was obtained from them. A total of 138 students were divided into six groups, with each group consisting of 23 students, meeting for

2 days per week (three batches per day). Within each group, students were further divided into inner and outer circles for the Fish bowl discussions, with those with odd roll numbers assigned to the inner circle and those with even roll numbers to the outer circle. In subsequent sessions, the groups were rotated to ensure that all students had the opportunity to participate in both roles (Figure 1).

Data Collection and Analysis: A pre-test comprising Multiple Choice Questions (MCQs) sourced from a validated departmental question bank was administered to all participants before the group assignments.

Fish bowl sessions

The Fish bowl technique has two circles:

- Inner circle: Students in the inner circle are called "fishes".
- Outer circle: The rest of the students in class form the outer circle, and they are called "fish watchers".

The chairs in the class were arranged in inner and outer circles for the Fish bowl method. Each group comprising 23 participants was divided into two circles based on their roll numbers. The first group of 12 students was asked to sit in an inner circle, which was further divided into three subgroups with participants in each subgroup (n = 4). Students were instructed to engage in discussions with representatives from their respective groups. Each subgroup spoke on the subtopic allotted to them. The other group, comprising the remaining 11 students, was asked to sit in the outer circle and observe the inner group (fishes). Fish watchers seated in the inner circle were given a tally/comment sheet and tasked with observing and grading their fish's contributions to the discussion. The grading criteria were as follows: i) relevance of the point of view expressed in the question/topic, ii) use of suitable evidence to substantiate their viewpoint, iii) the capability to stimulate and advance discussions among fellow students, and iv) adherence to the designated topic throughout the discussion. The positions of the inner and outer circles were swapped in the subsequent week to cover different pathological topics.

One faculty member per group supervised the group discussions, guided the enquiries into the topic being discussed, and helped to strengthen the group's overall understanding of the topic. Following the discussion, a plenary session was held, during which crucial points that had been missed were added and mistakes were corrected. The time allocated was as follows: 10 min for the Fish bowl discussion, 5 min each for the plenary sessions, and 15 min for the pre- and post-tests.

Finally, a post-Fish bowl assessment was conducted, and feedback was obtained from students regarding their views and experiences with the Fish bowl through a questionnaire using a Likert scale with ratings ranging from 1 to 5. Both the pre-test and post-test consisted of MCQs sourced from a validated question bank maintained by the department. These questions were used to determine the difficulty levels and discrimination indices. Changes in knowledge and learning outcomes were assessed by comparing scores between the pre-test and post-test MCQs.

Student feedback collected through a Likert-scale questionnaire was analysed to assess the acceptability and perceived effectiveness of the Fish bowl technique in facilitating learning.

Statistical Analysis: Data was entered and analyzed using IBM SPSS Statistics for Windows (version 20). The mean and standard deviation (SD) were calculated for post-lecture and post-Fish bowl assessment scores and analysed using a paired t-test. $P \leq 0.05$ was considered statistically significant.

Results

A statistical improvement was observed in post-test scores of the Fish bowl technique, with a gain of 16.81% ($t = -11.6$, $p \leq 0.001$) (mean = 4.7 ± 0.51) compared to pre-fish bowl (mean = 3.86 ± 0.86), as shown in table 1.

Table 1. Comparison of the student's performance in the pre- and post-tests

Marks	Frequency (N)	Mean (SD)	t value	p-value
Pre-test	138	3.86 (0.86)	-11.6	<0.001
Post-test	138	4.70 (0.51)		

Analysis of student feedback revealed that lectures followed by Fish bowl sessions generated more interest (75.36%), increased active participation (86.23%), and improved satisfaction with learning (73.91%) among students as compared to lectures only (Table 2).

The retention of the study subject, coverage of important concepts, and meaningful discussions were better in the lectures with the Fish bowl discussion. Fish bowl sessions helped students better understand the topic, and most students did not encounter any difficulties or problems during the sessions (Figure 2, Table 3).

Table 2. Feedback from the students regarding the lecture and Fish bowl technique

Feed Back	Lecture alone [n (%)]	Lecture with Fish bowl [n (%)]
Which method stimulated interest in learning?	34 (24.64)	104 (75.36)
Which teaching method involved your active participation?	19 (13.77)	119 (86.23)
Which method led to greater learning satisfaction?	36 (26.09)	102 (73.91)
Which method is better?	39 (28.26)	99 (71.74)

Table 3. Students feedback regarding Fish bowl

Feed Back	Yes (%)	No (%)	Maybe (%)
Did the Fish bowl method advance understanding of the topic?	57.25	4.35	38.41
Did you face any problems during the discussion of the topic?	5.07	87.68	7.25

Overall, students found the Fish bowl sessions to be positive learning experiences. These sessions were highly interactive and enjoyable, contributing to improved retention of the topic discussed (Figure 3).

Discussion

One of the biggest challenges faced by teachers in medical colleges is the lack of student's attentiveness, participation, and engagement in class (13, 14). According to researchers, small-group instruction offers numerous benefits and is considered a crucial component in achieving student success (6, 7).

Group discussions are an important part of students' overall education, whether in problem-based learning, team projects, or in the more conventional academic settings of tutorials or seminars. When executed well, discussion can provide students with more opportunities to express themselves in the subject language and build stronger relationships with faculty members (10). Moreover, the demanding curriculum of medical colleges needs to be made engaging by implementing innovative teaching and learning techniques (6, 15); one such approach is combining a lecture with a Fish bowl discussion.

The current study was conducted to investigate how medical students perceive the effectiveness of the Fish bowl technique as an innovative teaching tool for pathology to Phase 2 MBBS students. In our study, the mean scores of students' post-tests after Fish bowl sessions were significantly higher, with a gain of 16.81% compared to the pre-test, which aligns with studies on undergraduates (1, 4, 6, 16). Our study showed that lectures with Fish bowl discussions instilled an interest in learning in 75.36% of students, which was similar to the findings of Rabbani et al. (6) (86.7%) and Kundoor et al. (17) (81.17%). Lectures followed by discussions have always developed an interest in students. In Fish bowl discussion, the teacher plays the role of a facilitator, creating a welcoming and conducive atmosphere that fosters internal motivation for learning and piques students' interest (1, 9, 18).

Moreover, 86.23% of students agreed that Fish bowl discussions involved their active participation and helped clear their doubts, which is concordant with studies done by Anand et al. (4) (92%), Cerqueira et al. (16) and Hertling et al. (19) (90%), as it allows them to assume centre stage, encouraging participation through give-and-take situations and providing them with the opportunity to solve problems and learn from their peers (4, 19).

Students need to retain information from classes for interpretation and application of information (1). In our study, students could retain information better (81.88%) when a lecture was followed by a Fish bowl as it evoked interest, promoted active participation, and students were constantly involved in discussion. These findings are in concurrence with studies by Priyam et al. (1) (95%), Anand et al. (4) (72%), and Rabbani et al. (6) (70%). Most students felt that the Fish bowl discussions were meaningful and covered all important topics.

In our study, a lecture followed by a Fish bowl helped students better understand the topic. This strategy enhances knowledge by promoting interactive learning, stimulating curiosity, and fostering critical reasoning. Students preferred a combination of teaching methods (lectures with Fish bowls) over a single method in our study (71.74%). Studies conducted by Chaudhary et al. (20) (67.1%) and Rabbani et al. (6) (66.7%) concluded that students favoured a combination of teaching methods. The combination teaching approach is the most effective because it compensates for the inherent shortcomings of a single method with another (21). Overall, the students had a positive learning experience

with the lecture, followed by the Fish bowl, with improved learning satisfaction. Few students face the barrier of shyness or fear of stage fright, which can be overcome by applying this technique more often, allowing them to gradually feel more comfortable with it and subsequently participate in discussions.

Limitations: This study was conducted at a single medical college and involved a limited number of students over a specified duration. To enhance the robustness of this method, future studies should be conducted on a larger scale encompassing diverse medical colleges and other educational institutions. In addition, the number of Fish bowl sessions was limited. Further studies with longer duration and increased exposure to the Fish bowl technique could help alleviate student shyness, gradually increase their comfort levels, and facilitate more participation with increased confidence.

Conclusion

This study has demonstrated the effectiveness of the Fish bowl method and concluded that integrating both traditional and innovative teaching approaches has a positive impact on learning outcomes in pathology. The Fish bowl method is one of the effective student-centric learning methods that promotes critical thinking, curiosity, interest in the topic, improves memory retention, and gives students the confidence to articulate their perspectives. The Fish bowl technique is rarely used for short group discussions in medical education. The Fish bowl method can be implemented in the medical curriculum to enhance teaching efficiency.

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References

1. Priyam S, Sankeshwari RM, Vyavahare S, Ankola AV. Comparison of routine teaching with Fish bowl and 1-min preceptor for dental undergraduate students: an interventional study. Indian J Dent Res. 2020 Jan-Feb;31(1):48-52. doi: 10.4103/ijdr.IJDR_231_18. [PMID: 32246681]
2. Torre DM, Daley BJ, Sebastian JL, Elnicki DM. Overview of current learning theories for medical educators. Am J Med. 2006 Oct;119(10):903-7. doi: 10.1016/j.amjmed.2006.06.037. [PMID: 17000227]
3. Devi DV, Deedi MK. Teaching and learning methodology in medical education: an analysis-in GSL Medical College, Rajahmundry, AP. J Evol Med Dent Sci. 2015 Sep 7;4: 12557-65. doi:10.14260/jemds/2015/1808.
4. Anand N, Pujar S, Rao S. A heutagogical interactive tutorial involving Fish bowl with Fish Battle and Round Robin Brainstorming: A novel syndicate metacognitive learning strategy. Med J Armed Forces India. 2021 Feb 2;77(Suppl 1): S73–S78. doi: 10.1016/j.mjafi.2020.12.003. [PMID: 33612935] [PMCID: PMC7873678]
5. Irby DM. What clinical teachers in medicine need to know? Academic Medicine. 1994; 69(5): 333-42. doi:10.1097/00001888-199405000-00003.
6. Rabbani H, Tarannum F, Chavan VM, Ali SI. Fish-Bowl Teaching Technique in Phase III Mbbs Students: An Observational Study. J Cardiovasc Dis Res. 2023; 14(3): 396-401.
7. Pate-Bain H, Boyd-Zaharias J, Cain Van A, Word E, Binkley E. The State of Tennessee's Student/Teacher Achievement Ratio (STAR) Project. Lebanon, TN: HEROS, Inc; 1997.
8. Coles C. Variability of student ratings of accounting teaching: evidence from a Scottish business school. International Journal of Management Education. 2002;2(2):30-40.
9. Rathnakar UP, Gopalakrishna HN, Pai PG, Ullal SD, Pemminati S, MRSM P, et al. Didactic lectures and interactive sessions in small groups: a comparative study among undergraduate students of pharmacology in India. Journal of Clinical and Diagnostic Research. 2010;4(2):2260-4.
10. Pavani G. Fish bowl teaching technique for IIND year MBBS students in AIMSR. J Evolution Med Dent Sci. 2016 Apr 21;5(32):1713-5. doi:10.14260/jemds/2016/404.
11. Jaques D. ABC of learning and teaching in medicine-Teaching small groups. British Medical Journal. 2003 Mar 1;326 :492-4. doi:10.1136/bmj.326.7387.492.
12. Tint SS, Nyunt EE. Collaborative learning with think-pair-share technique. Computer Applications: An International Journal. 2015 Feb;2(1):1-11. doi:10.5121/caij.2015.2101.
13. Hegde AM, Shetty S, Mehrotra D. Comparison of Class Room Lectures with Fish bowl-Snowball Activity for Dental Undergraduate Students: An Observational Study. Journal of Health and Allied Sciences NU. 2023; 13(03): 395-9. doi:10.1055/s-0042-1757731.
14. Grabosky F. The dynamic commitment design. Small group behavior. 1985 Feb; 16(1): 111-9. doi: 10.1177/104649648501600107.
15. Singh V, Kharb P. A paradigm shift from teaching to learning gross anatomy: meta-analysis of implications for instructional methods. Journal of the Anatomical Society of India. 2013 Jun 1;62(1):84-9. doi:10.1016/S0003-2778(13)80019-6.
16. Santos Cerqueira G, Silva RS, da Santos Silva JM, Naconecy de Souza HS, Pimenta Bindá HS, da Silva ID, et al. Fish bowl as Pedagogical Innovation in Anatomy Teaching. The FASEB Journal. 2022 May;36(S1). doi:10.1096/fasebj.2022.36.S1.0R412.
17. Kundoor N, Sannidhi S, Bashetty B. Effectiveness of Fish bowl method in teaching clinical biochemistry for 1st year medical students. International Journal of Medical Science and Education. 2019;6(1):27-31.
18. Brophy J. Synthesis of research on strategies for motivating students to learn. Educational leadership. 1987;45(2):40-8.
19. Hertling S, Hertling D, Matziolis G, Schleußner E, Loos F, Graul I. Digital teaching tools in sports medicine: A randomized control trial comparing the effectiveness of virtual seminar

and virtual Fish bowl teaching method in medical students. PloS One. 2022 Jun 16; 17(6): e0267144. doi: 10.1371/journal.pone.0267144.

20. Choudhary R, Dullo P, Gupta U. Attitude of 1st MBBS medical students about two different visual aids in physiology lectures. Pakistan Journal of Physiology. 2009 Dec 31;5(2):16-9.

21. Priyadarshini KS, Shetty HV, Reena R. Assessment of different teaching aids and teaching methods for the better perception of biochemistry by 1st MBBS students. Journal of Evolution of Medical and Dental Sciences. 2012; 1(6): 1159-65. doi: 10.14260/jemds/189.

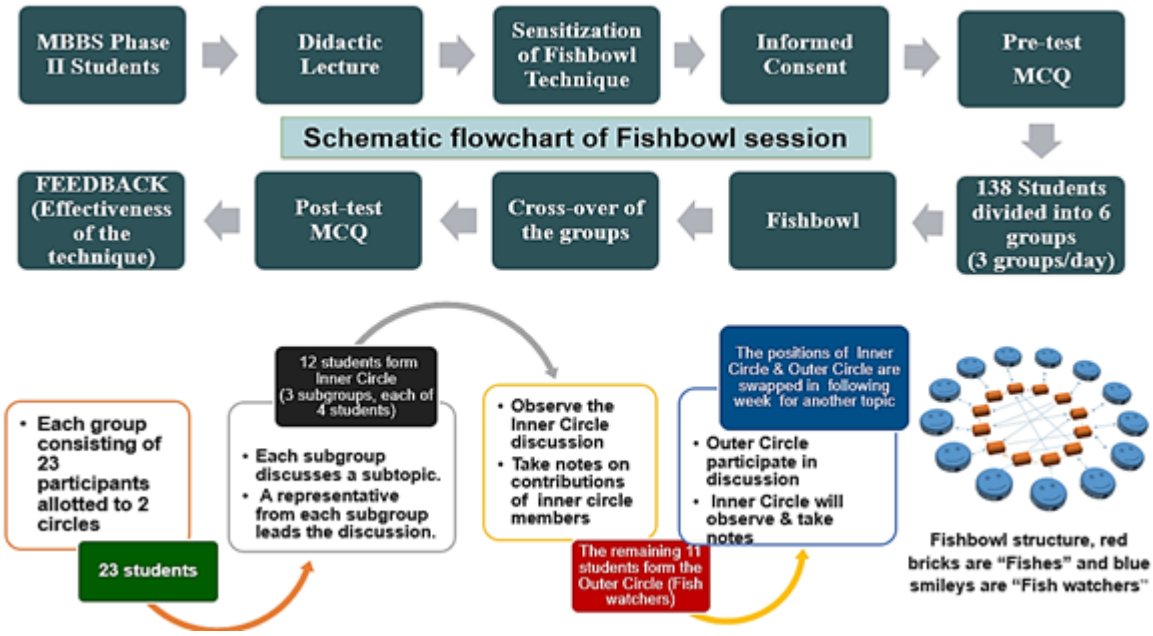

Figure 1. Schematic flowchart of Fish bowl session

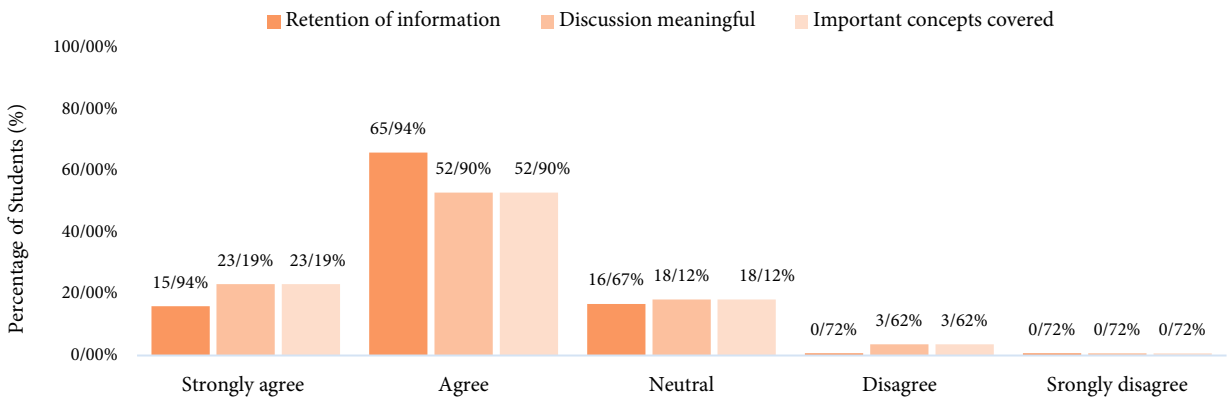

Figure 2. Students' perception regarding Fish bowl

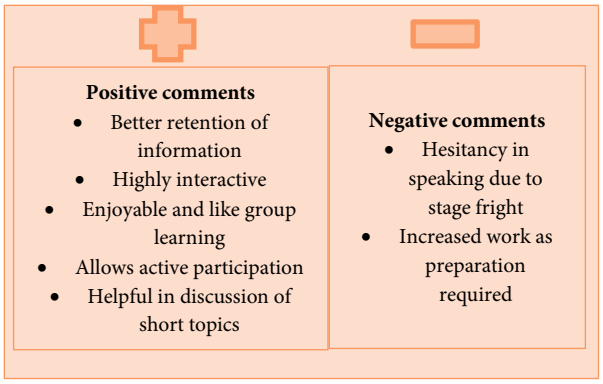

Figure 3. Positive and negative opinions of students regarding Fish bowl

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Original Article

Pilot Implementation and Evaluation of a Mobile-Based Educational Application to Enhance E-Learning Skills in Faculty Members

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Abstract

Background: E-learning has become an essential element of modern education, significantly enhancing instructional effectiveness. Empowering faculty members through structured e-learning programs is vital for improving their teaching skills, particularly in medical education, where flexibility and digital literacy are increasingly important.

Objectives: This study aimed to implement and evaluate a mobile-based educational program and a specialized e-learning empowerment course for faculty members, focusing on professional development in digital instruction and medical education.

Methods: This quasi-experimental study, employing a design and development approach focused on educational tool creation and pilot evaluation, followed a systematic process. It began with a review of the literature and expert consultations to identify the educational and technical needs of faculty members. A needs assessment questionnaire was administered to 30 purposively selected faculty members. Using the ASSURE instructional design model, the application—including platform design and programming—was developed. A pilot version was tested for two weeks on another group of 30 faculty members. Feedback was collected, and iterative improvements were made. Data were analyzed using SPSS, focusing on user satisfaction and learning outcomes.

Results: Faculty members showed moderate familiarity with instructional design models and limited knowledge of content authoring tools. The participants achieved an average score of 9.8 out of 12 and reported high satisfaction with usability, content quality, and functionality.

Conclusion: The study effectively identified faculty development needs and integrated them into a tailored mobile application. The pilot evaluation indicated high satisfaction and educational impact, offering a promising model for developing future digital tools to support faculty empowerment in higher education.

Keywords: E-Learning; Faculty Members; Application; Empowerment Course; ASSURE Model

Background

The rapid advancement of science and technology in recent decades has introduced significant challenges for educational systems, particularly in the fields of higher education and medical instruction (1). Faculty members, as key agents of academic and scientific development, play a pivotal role in improving the quality of teaching and learning (2). Nevertheless, empowering faculty members continues to be a major challenge within higher education due to the presence of various structural, technical, and pedagogical gaps (3, 4).

A recent study conducted at an Iranian medical university during the COVID-19 pandemic shows that, despite the widespread adoption of online education, substantial challenges persist—most notably insufficient digital proficiency among faculty members, inadequately designed instructional content, and the absence of structured faculty development programs (5).

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Furthermore, the growing complexity of teaching and learning processes as a result of digital transformation calls for a fundamental rethinking of traditional pedagogical practices and the incorporation of innovative educational approaches. These issues are especially pronounced in medical education, where flexible, specialized instructional strategies are essential for effective knowledge and skill development (6). Several studies suggest that emerging educational technologies offer promising solutions for these challenges and can contribute to the enhancement of faculty competence in digital environments, thereby improving the overall quality of education (2, 7). E-learning, in particular, has emerged as an effective strategy by providing an accessible, interactive, and flexible learning environment that facilitates the professional development of faculty members. Due to its advantages, such as ease of access, interactive content delivery, and support for diverse learning preferences, e-learning has become a central component of faculty development programs across various academic contexts (7). The effectiveness of digital education, however, is highly dependent on the systematic and scientific design of teaching and learning processes. A growing body of evidence supports the use of educational technologies that are informed by instructional design models and educational needs assessments, particularly in medical education settings (8, 9).

In this regard, some studies have reported that customized mobile applications can enhance teaching performance and increase user satisfaction when properly designed (9, 10).

One of the most recognized instructional design frameworks is the ASSURE model, which provides a structured, learner-centered approach to planning and implementing technology-based instruction (11). The model outlines specific steps, including learner analysis, objective formulation, media selection, instructional delivery, and outcome evaluation (12). A notable feature of the ASSURE model is its emphasis on individual learner differences and its adaptability to various instructional contexts, making it especially suitable for e-learning in medical education (13).

Given the substantial costs associated with developing e-learning infrastructure and educational software—alongside the time-intensive nature of creating high-quality digital content—leveraging institutional experience and promoting collaboration between the public and private sectors becomes essential. To that end, a scientifically grounded understanding of the components of digital education is necessary, and the process of change must be carefully aligned with both current institutional realities and ideal educational standards in medical training.

Accordingly, the present study aimed to develop a specialized mobile-based educational application and to conduct its pilot implementation and evaluation, with a specific focus on the digital empowerment of faculty members in medical universities.

Objectives

This study aimed to implement and evaluate a mobile-based educational program and a specialized e-learning empowerment course for faculty members, focusing on professional development in digital instruction and medical education.

Methods

This quasi-experimental research used a design and development approach. The aim was to design, implement, and evaluate a mobile-based educational application to enhance the digital teaching competencies of medical education faculty members during the 2022–2023 academic year. The research process was conducted in five structured stages.

- Needs assessment
- Questionnaire development
- Application design and development
- Pilot implementation
- Evaluation

The instructional framework throughout the study was based on the ASSURE model, which guided the systematic planning, development, and deployment of both content and technology.

Participants

A total of 60 participants were involved across two distinct research phases, with 30 individuals assigned to each phase as independent groups. The sample size of 30 participants per phase was determined according to established methodological guidance and conventions for developmental and pilot studies in medical education (14), ensuring sufficient statistical power for meaningful descriptive analysis and pilot evaluation. The two groups were completely independent, with no overlap between the participants, to prevent bias and maintain the integrity of each research phase.

Expert Interviewees (Needs Assessment Phase): Seven subject-matter experts in e-learning, medical education, and software development were selected via purposive

and snowball sampling. These experts participated in in-depth interviews to help identify the core instructional and technical requirements for faculty development.

Questionnaire Respondents (Needs Validation Phase): Based on the expert interviews, a structured checklist was developed and used to inform the creation of a formal needs assessment questionnaire. This questionnaire was distributed to 30 faculty members at Shahid Beheshti University of Medical Sciences, selected through purposive sampling. Inclusion criteria were a minimum of two years of teaching experience and at least a moderate level of digital literacy.

Pilot Implementation Group: A separate group of 30 new faculty members, entirely distinct from those in the previous phases, participated in the pilot phase. These participants were selected using non-random purposive sampling. To ensure consistency and reduce confounding variables, only those who had completed a formal e-learning training course and held a valid completion certificate were invited. After obtaining informed consent, the participants received installation instructions and access credentials for the application.

Data Collection

Multiple qualitative and quantitative methods were used for data collection:

Expert Interviews and Checklist Development

Interviews with the seven selected experts were conducted via phone, email, or in-person meetings. Transcripts were thematically analyzed to identify recurring concepts, which were synthesized into a 44-item checklist of educational and software-related needs.

Questionnaire Construction and Distribution

A 51-item Likert-scale questionnaire was created based on the checklist and structured into three sections:

- Demographic data
- Instructional needs and goals
- Preferences for software features and interface design

The Content Validity Index of the questionnaire was calculated as 0.763, based on evaluations by five university faculty experts. The reliability of the questionnaire was confirmed using Cronbach's alpha ($\alpha = 0.742$), and its test–retest reliability was assessed using the intraclass correlation coefficient (ICC = 0.993). The questionnaire was distributed electronically to 30 faculty members.

Instructional Design and Application Development

Guided by the ASSURE model, the instructional component was designed with defined objectives, syllabi, interactive learning activities, and multimedia materials (PDFs, videos, audio files). In parallel, the application was developed as a hybrid web-based platform through six technical phases:

- Requirement gathering
- UI/UX design
- Front-end development
- Back-end programming
- Management panel integration
- Final deployment

Pilot Implementation

The mobile application was piloted over a two-week period with the new group of 30 faculty members. The participants interacted with the platform independently and received continuous educational and technical support throughout. Real-time feedback was used to inform iterative improvements to the system.

Data Analysis

Evaluation of the pilot implementation was conducted using two tools:

Learning Assessment: A 12-item multiple-choice exam, aligned with the course syllabus, was developed to assess knowledge acquisition. The test was reviewed by academic experts and demonstrated acceptable reliability ($\alpha = 0.75$).

Usability and Satisfaction Questionnaire: An 87-item standardized usability questionnaire, based on the Patrick-Crick model, was used to assess the following dimensions:

- System usefulness and efficiency
- Ease of use and learning curve
- User satisfaction and interaction quality
- Interface design, personalization, and error handling

Responses were collected on a 5-point Likert scale.

Statistical Tests

Data were analyzed using IBM SPSS Statistics version 23. Descriptive statistics—including mean, standard deviation, frequency, and percentage—were used to summarize the participants' responses and outcomes. Internal consistency of the instruments was measured using Cronbach's alpha. Test–retest reliability of the needs assessment questionnaire was assessed using Pearson's correlation coefficient. Content validity was examined through expert ratings and calculation of the Content Validity Index.

To compare learning outcomes between the groups, inferential statistical tests were applied. The independent samples t-test was used to examine differences based on gender, and ANOVA was employed to compare academic ranks. A significance level of $p < 0.05$ was considered.

Results

Demographic Characteristics: A total of 30 faculty members participated in the pilot implementation phase. Of them, 18 participants (60%) were female and 12 (40%) were male. The participants had a mean age of 42 ± 7 years and an average of 14 ± 6 years of professional teaching experience. Regarding academic rank, 15 participants (50%) were assistant professors, 11 (36.6%) were associate professors, and four (13.33%) were full professors. In terms of academic specialization, half of the participants (50%) were from clinical sciences and the other half (50%) from basic sciences (Table 1).

Table 1. Demographic Characteristics

Variable	n (%)	Mean (SD)
Gender		
Female	18 (60.0)	
Male	12 (40.0)	
Academic Rank		
Assistant Professor	15 (50.0)	
Associate Professor	11 (36.6)	
Full Professor	4 (13.3)	
Specialization		
Clinical Sciences	15 (50.0)	
Basic Sciences	15 (50.0)	
Age		42 (7)
Teaching Experience (Years)		14 (6)

To evaluate the participants' reactions to the educational application, a comprehensive usability and satisfaction questionnaire was administered following the two-week pilot phase. The instrument was based on the level 1 (reaction) dimension of the Kirkpatrick model and included 87 items across nine thematic sections. The participants responded to each item using a binary format (yes/no), indicating whether the system met their expectations in each specific area (Table 2) (Appendix 1).

Table 2. Mean Positive Response Rates per Domain – Level 1 Reaction (Kirkpatrick Model)

Section	Positive response percentage
Accessibility & New Tech	85.7
Content & System Info	95.7
Ease of Learning	97.7
Ease of Use	96.5
Error Management	86.8
General Reaction	98.2
Satisfaction	100
System Personalization	94.0
Usefulness	100

Findings from the usability and satisfaction evaluation indicate consistently high performance across all assessed domains. The participants reported complete satisfaction (100%) with system usefulness, overall satisfaction, and the integration of multimedia components. Similarly, strong positive responses were observed in areas such as ease of use, ease of learning, content clarity, user interface personalization, and overall interaction with the system. While slightly lower satisfaction levels were noted in domains related to accessibility and error control, the overall results demonstrate a high degree of user approval and reflect substantial alignment between the system's design and established instructional quality standards.

Learning Assessment Results: To assess the effectiveness of the instructional intervention, a post-course learning assessment was administered to the participants following the completion of the pilot program. The assessment comprised 12 multiple-choice questions (maximum possible score = 12), designed to comprehensively evaluate the participants' understanding of the course content. The questions were carefully aligned with the learning objectives and covered a broad range of topics, ensuring content validity and cognitive diversity.

No statistically significant differences were observed in learning outcomes based on gender or academic rank, indicating that both male and female participants, as well as faculty members across different academic ranks, demonstrated similar levels of knowledge acquisition (Table 3).

Table 3. Learning Assessment by Gender and Academic Rank

Variable	Participants	Mean (SD)	p-value
Gender			0.07
Female	12	9.70 (0.60)	
Male	18	9.90 (0.07)	
Academic Rank			0.22
Assistant Professor	15	9.80 (0.50)	
Associate Professor	11	9.70 (0.60)	
Full Professor	4	9.90 (0.40)	

The mean score across the participants was 9.8 ± 0.5, suggesting a relatively high level of knowledge acquisition. This result implies that the educational content delivered through multimedia formats within the application effectively supported conceptual understanding and retention. The observed performance underscores the effectiveness of the instructional design approach, guided by the ASSURE

model, in fostering learner engagement and ensuring the achievement of educational outcomes.

These findings provide preliminary evidence of the instructional efficacy of the mobile-based training intervention and validate its potential for use in broader faculty development initiatives.

Discussion

The findings of this study demonstrated that learning outcomes and user satisfaction following participation in the mobile-based training program were remarkably high, with response rates nearing 100% across multiple dimensions. In particular, the usability and satisfaction questionnaire revealed consistently high ratings across all domains. The participants reported full satisfaction with overall usefulness, multimedia content, general reaction, and ease of learning. These results affirm the system's effectiveness in meeting educational expectations and supporting digital teaching competencies.

Such outcomes align with the pedagogical principles of the ASSURE instructional design model, especially in its emphasis on learner analysis, media selection, and continuous evaluation. The high ratings in domains such as ease of navigation, content clarity, and user interface personalization reflect the successful implementation of the "Select Methods, Media, and Materials" and "Utilize Media and Materials" phases. Notably, satisfaction with the system's ability to deliver engaging multimedia content further underscores the relevance of multimodal strategies in faculty development programs.

These results are consistent with those reported by Elmaiah et al. (15), who found that during the COVID-19 pandemic, user demand for mobile applications was highest in the categories of healthcare, gaming, and education. Their analysis included app attributes such as name, category, cost, size, latest version, connectivity requirements, download statistics, user satisfaction, and developer intent—all of which resonate with the current study's focus on educational app design and evaluation.

Our results further highlight the need to emphasize training in instructional design models, e-teaching methods, and digital assessment tools when developing e-learning courses for medical faculty. These observations are in line with the findings of Karimi et al. (16), who emphasized the importance of addressing faculty members' design-related needs in professional development initiatives. Similarly, Serafraz et al. (2) reported that digital learning environments contribute significantly to improving the overall quality of higher education.

The current findings are also supported by Naderi et al. (17), who demonstrated the effectiveness of mobile learning in enhancing time and resource management, initiative, and student engagement. Zarrati et al. (18) found that learners using digital tools—including computers and smartphones—exhibited stronger long-term vocabulary retention. Likewise, Chase et al. (19) showed that medical students exposed to mobile-based learning achieved significantly higher academic outcomes compared to those in traditional instruction. Allahi et al. (20) reported that mobile-enriched learning environments had a positive effect on motivation, engagement, and academic performance among students with visual impairments. Shan et al. (21) further supported the role of mobile applications as effective educational tools in managing chronic diseases such as diabetes mellitus. Matook et al. (1) emphasized the importance of mobile technologies in clinical education, particularly when integrated with appropriate infrastructure and institutional support. Additionally, Motahari et al. (22) demonstrated that smartphone-based triage training improved emergency nurses' decision-making accuracy, aligning with the current study's conclusions.

These findings collectively suggest that mobile technologies are playing an increasingly critical role in the evolution of education. As new concepts, strategies, and methods emerge, mobile-based learning offers unique opportunities to enrich instructional delivery, support faculty development, and enhance learner engagement. A key strength of this study lies in its comprehensive needs assessment and the development of a tailored application by experts in e-learning, medical education, and instructional technology. By addressing specific professional development needs, this intervention provides a novel and practical model for faculty empowerment in digital education.

One limitation of this study was the limited availability of faculty members, which constrained access for interviews, survey participation, and pilot implementation. Due to time constraints and scheduling challenges, not all interviews and questionnaires could be conducted in person. As a result, some interviews were conducted by phone, and the questionnaires were distributed electronically. While these approaches allowed for broader participation, they may have

influenced the depth of engagement and the richness of qualitative insights obtained.

Conclusion

This study highlights the importance of mobile learning in medical education and the expanding role of e-learning as a core component of instructional innovation. As a symbol of technology integration in education, e-learning aligns with foundational values such as learner-centeredness, active and interactive learning, multimedia-based instruction, and lifelong learning.

The findings of this research revealed a high level of educational need among faculty members in the domain of e-learning. Throughout the study, the participants' expectations, preferences, and priorities regarding the app's features and content were systematically assessed and incorporated into the application. Evaluation results indicated that the participants achieved acceptable levels of learning and expressed overall satisfaction with the mobile-based course.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The present research is the result of the ethical code IR.SBMU.SME.REC.1398.037, approved by Shahid Beheshti University of Medical Sciences of Iran. The purpose of the study was explained to the participants, and they were assured that the information would remain confidential. Participation in the study was voluntary, and they could withdraw from the study at any time. Informed consent was obtained from all the participants involved in the study. The present study was carried out in compliance with relevant guidelines and regulations.

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References

1. Maatuk AM, Elberkawi EK, Aljawarneh S, Rashaideh H, Alharbi H. The COVID-19 pandemic and E-learning: challenges and opportunities from the perspective of students and instructors. J Comput High Educ. 2022;34(1):21-38. doi: 10.1007/s12528-021-09274-2. [PMID: 33967563] [PMCID: PMC8091987]
2. Alyoussef IY. Acceptance of e-learning in higher education: The role of task-technology fit with the information systems success model. Heliyon. 2023 Mar;9(3):e13751. doi: 10.1016/j.heliyon.2023.e13751. [PMID: 36845042] [PMCID: PMC9938001]
3. Peist E, McMahon SD, Davis JO, Keys CB. Teacher turnover in the context of teacher-directed violence: An empowerment lens. Journal of School Violence. 2020;19(4):553-65. doi:10.1080/15388220.2020.1779081.
4. Wilcoxen C, Bell J, Steiner A. Empowerment through induction: Supporting the well-being of beginning teachers. International Journal of Mentoring and Coaching in Education. 2020;9(1): 52-70. doi:10.1108/IJMCE-02-2019-0022.
5. Mohammadi A, Norouzadeh R, Hosseini SE, Mohammadi M, Tahrekhani M. Investigating the Effectiveness of Online Learning in the Post-Coronavirus (COVID-19) Era from the Perspectives of Students and Faculty Members of Selected Universities of Medical Sciences in Iran. Strides Dev Med Educ. 2025;22(1): e1447. doi:10.22062/sdme.2025.200378.1447.
6. Tindowen DJ. Influence of empowerment on teachers' organizational behaviors. European Journal of Educational Research. 2019;8(2):617-31. doi:10.12973/eu-jer.8.2.617.
7. Mastour H, Shamaeian Razavi N, Sohrabi S. Enhancing Medical Education: Learning Engineering and Technologies for Training Future Healthcare Professionals. Strides Dev Med Educ. 2025;22(1): e1468. doi:10.22062/sdme.2025.200504.1468.
8. Chen CH, Tsai CC. In-service teachers' conceptions of mobile technology-integrated instruction: Tendency towards student-centered learning. Computers & Education. 2021;170:104224. doi:10.1016/j.compedu.2021.104224.
9. Marunevich O, Kolmakova V ,Odaruyk I, Shalkov D. E-learning and M-learning as tools for enhancing teaching and learning in higher education: a case study of Russia. SHS Web of Conferences; 2021; 110: 8. doi:10.1051/shsconf/202111003007.
10. Zare Karizi A, Shirani-Bidabadi L, Aghaei- Afshar A, Gorouhi MA, Shirani- Bidabadi N, Alizadeh I, et al. Designing and Building a Mobile Educational Software Application for the Laboratory of Morphology and Physiology of Medically Important Insects and Assessing Students' Satisfaction Levels. Strides in Development of Medical Education, 2025; 22(1): e1399. doi: 10.22062/sdme.2024.199991.1399.
11. Boldureanu G, Ionescu AM, Bercu A-M, Bedrule-Grigoruță MV, Boldureanu D. Entrepreneurship education through successful entrepreneurial models in higher education institutions. Sustainability. 2020;12(3):1267. doi:10.3390/su12031267.
12. Lei G. Influence of ASSURE model in enhancing educational technology. Interactive Learning Environments. 2023; 32(7): 3297-313. doi:10.1080/10494820.2023.2172047.
13. Khene ZE, Larcher A, Bernhard JC, Doumerc N, Ouzaid I, Capitanio U, et al. External validation of the ASSURE model for predicting oncological outcomes after resection of high-risk renal cell carcinoma (RESCUE study: UroCCR 88). Eur Urol Open Sci. 2021 Oct 5:33:89-93. doi: 10.1016/j.euros.2021.09.004. [PMID: 34661173] [PMCID: PMC8502703]
14. Prados-Carmona A, Fuentes-Jimenez F, Roman de Los Reyes R, García-Rios A, Rioja-Bravo J, Herruzo-Gomez E, et al. A Pilot Study on the Feasibility of Developing and Implementing a Mobile App for the Acquisition of Clinical Knowledge and Competencies by Medical Students Transitioning from Preclinical to Clinical Years. Int J Environ Res Public Health. 2022 Feb 27;19(5):2777. doi: 10.3390/ijerph19052777. [PMID: 35270471] [PMCID: PMC8910514]
15. Almaiah MA, Alismaiel OA. Examination of factors influencing the use of mobile learning system: An empirical study. Education

and Information Technologies. 2019;24(1):885-909. doi:10.1007/s10639-018-9810-7.

16. Karimi F, Hosseini M, Malekpour A, Moezzi M, Hosseini A, Raisi N, et al. Needs assessment of faculty members' educational needs in order to empower them at Shahrekord University of Medical Sciences. Journal of Development Strategies in Medical Education. 2019;6(1):47-59. [In Persian]
17. Naderi F, Ayati M, Akbari Boorang M, Zare Bidaki M. Impact of mobile-based education on time and place management study, Resource management (effort and planning) and reviewing learners' attitude about this learning style . Journals of Birjand University of Medical Sciences 2018; 25 :27-36. [In Persian]
18. Zarrati Z, Zohrabi M, Abedini H, Xodabande I. Learning academic vocabulary with digital flashcards: Comparing the outcomes from computers and smartphones. Social Sciences & Humanities Open. 2024 Jan 1;9:100900. doi: 10.1016/j.ssaho.2024.100900.
19. Chase TJ, Julius A, Chandan JS, Powell E, Hall CS, Phillips BL, et al. Mobile learning in medicine: an evaluation of attitudes and behaviours of medical students. BMC Med Educ. 2018 Jun 27;18(1):152. doi: 10.1186/s12909-018-1264-5. [PMID: 29945579] [PMCID: PMC6020287]
20. Allahi Z, Bakhtiarvand M, Dehzireh MR. The Effect of Instruction Through Mobile Phone-Based Virtual Networks on the Learning Rate of Students with Visual Impairment. Randwick International of Education and Linguisticsb Science (RIELS) Journal. 2020;1(2):199-207. doi:10.47175/rielsj.v1i2.86.
21. Shan R, Sarkar S, Martin SS. Digital health technology and mobile devices for the management of diabetes mellitus: state of the art. Diabetologia. 2019 Jun;62(6):877-887. doi: 10.1007/s00125-019-4864-7. [PMID: 30963188]
22. Motaarefi H, Sakhaei S, Ashrafi M, Zinalpoor S, Gholizadgougjehyaran H. The Effect of Smartphone-based Training of Triage the Knowledge and Decision Making of Emergency Nurses. Journal of Rafsanjan University of Medical Sciences. 2022; 21(2):137-48. doi: 10.52547/jrums.21.2.137.

Appendix 1. Applicability Table

Questions	Yes	No	Total
	n (%)		
Questions of the first part: the usefulness of the system			
The system helps me be more effective and productive.	30 (100)	0 (0)	30 (100)
The system helps to increase the effectiveness of my work activities.	30 (100)	0 (0)	30 (100)
The system is useful and valuable.	30 (100)	0 (0)	30 (100)
Questions of the Second part: ease of use			
The system is easy and simple to use.	28 (96.5)	1 (3.5)	29 (100)
Using the system is simple (uncomplicated).	28 (96.5)	1 (3.5)	29 (100)
Questions of the third part: ease of learning			
I learned how to use the system very quickly.	29 (100)	0 (0)	29 (100)
I simply memorized how to use the system.	28 (96.5)	1 (3.5)	29 (100)
User training and learning for system users is easy.	28 (96.5)	1 (3.5)	29 (100)
Questions of the fourth part: satisfaction			
I am satisfied with the system.	28 (100)	0 (0)	28 (100)
I recommend the system to friends.	28 (100)	0 (0)	28 (100)
Questions of the Fifth part: content output, corrections and system information			
The letters are readable on the screen.	28 (100)	0 (0)	28 (100)
Important operations and tasks are highlighted.	25 (86.2)	4 (13.8)	29 (100)
Organization of information on the screen is convenient.	28 (96.5)	1 (3.5)	29 (100)
The order and sequence of access to multiple pages is appropriate.	29 (100)	0 (0)	29 (100)
Questions of the sixth part: personalization of the user environment and other system capabilities			
The processing and interactive speed of the system is favorable.	26 (92.8)	2 (7.1)	28 (100)
The reliability of the system is desirable.	27 (96.4)	1 (3.6)	28 (100)
The ability to correct system user errors is desirable.	26 (92.8)	2 (7.1)	28 (100)
Questions of the seventh part: error management and control by the user			
In any state of the system, the user can return to the previous state.	26 (92.8)	2 (7.1)	28 (100)
Warnings and feedback are provided on time.	25 (89.2)	3 (10.8)	28 (100)
The system has provided facilities for more user control (such as Style Sheet).	22 (78.5)	6 (21.5)	28 (100)
Questions of the eighth section: general applicability and new interaction technologies			
The difference in users' vision (depth, contrast, color blindness, etc.) is considered in the interaction of the system with the user.	24 (85.7)	4 (14.3)	28 (100)
The auditory difference of the users is considered in the interaction of the system with the user.	26 (92.8)	2 (7.1)	28 (100)
The difference in users' sense of touch is taken into account in the interaction of the system with the user.	21 (75.0)	7 (25.0)	28 (100)
The personality differences of users in terms of response to stimuli (introversion or extraversion, emotional or reasoning) are considered in the interaction of the system with the user.	(25)89.2	(3)10.8	28 (100)
Questions of the ninth part: General reaction to the system			
General applicability and new interaction technologies (it is great)	27 (96.4)	1 (3.6)	28 (100)
General applicability and new interaction technologies (it is easy)	28 (100)	0 (0)	28 (100)

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Brief Report

Assessing the Educational Climate in Operating Rooms at Teaching Hospitals Affiliated with Birjand University of Medical Sciences from the Perspectives of Operating Room and Anesthesiology Students

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Abstract

Background: The educational environment is defined as the academic atmosphere within a university from the perspectives of all its members, and the clinical environment, as an indispensable and vital component of clinical education, plays a crucial role in achieving educational goals.

Objectives: The present study aimed to assess the educational environment of operating rooms in teaching hospitals affiliated with Birjand University of Medical Sciences.

Methods: This descriptive-analytical cross-sectional study was conducted on 266 undergraduate operating room and anesthesiology students at Birjand University of Medical Sciences in 2023. Sampling was performed in a convenience and purposeful manner from eligible educational departments. The Iranian Measure of Operating Theater Educational Climate (IMOTEC) questionnaire was employed for data collection. Data were analyzed using Mann-Whitney U and Kruskal-Wallis tests in SPSS software at a 95% confidence level.

Results: The mean score of the operating room educational climate was assessed as favorable (68.68 ± 19.48). Among the demographic variables, it was reported that age and academic semester had significant relationships with the mean score of the operating room educational climate (P = 0.026).

Conclusion: Most operating room and anesthesiology students at Birjand University of Medical Sciences perceived the operating room educational climate as favorable. However, it is advisable for responsible authorities to make decisions that improve the quality of education and minimize educational disparities across centers.

Keywords: Education; Operating Room; Teaching Hospital; Students

Background

The educational environment, defined as the academic atmosphere within a university from the perspectives of all its members, is widely recognized for its impact on student success, satisfaction, and achievement (1). In universities of medical sciences, clinical education constitutes a fundamental and crucial component across all disciplines. This form of education enables students to apply theoretical concepts in practice through interaction with instructors and the clinical environment (2). It is important to note that the learning of medical students in clinical environments is largely influenced by the effectiveness of this educational environment. Inadequate planning in this area can culminate in challenges, ultimately resulting in deficient professional skills and reduced efficacy among graduates (3). Experts in medical education believe that the educational environment, despite its intangible

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nature, has a fundamental, real, and pervasive impact on student learning. This environment profoundly influences students' learning experiences, and a positive educational environment is crucial for effective learning (4). As a suitable clinical environment, the operating room provides a valuable opportunity for students to develop and advance clinical skills related to preoperative, intraoperative, and postoperative care. This allows them to integrate their theoretical knowledge with practical application and enhance their proficiency through practice and repetition (5). Paying attention to the essential point that operating room and anesthesiology students must be trained in a clinical environment due to the nature of their fields makes it essential for educational centers to further strengthen the clinical skills of such students (6). A study by Towliat et al. revealed that one of the most significant challenges in clinical education, from the perspectives of operating room students, is the educational environment (7). Similarly, in a study by Negash and Hanago, the attitudes of anesthesiology students toward their educational environment were positive but not excellent, suggesting a need for further efforts to improve the educational environment and enhance students' academic success (8). In this regard, research has consistently recommended continuous evaluation of the educational environment's quality as a fundamental step in improving educational quality (9).

Given the existing research and the importance of the educational environment, particularly in clinical education, and considering that the operating room serves as a site for student clinical education, this study aims to assess the educational environment of operating rooms at teaching hospitals affiliated with Birjand University of Medical Sciences.

Objectives

The present study aimed to assess the educational environment of operating rooms in teaching hospitals affiliated with Birjand University of Medical Sciences.

Methods

Research Design: This descriptive-analytical, cross-sectional study was conducted in the academic year 2023 to assess the educational environment of operating rooms at teaching hospitals affiliated with Birjand University of Medical Sciences from the perspectives of operating room and anesthesiology students.

Participants and Sampling: The study population comprised all undergraduate anesthesiology and operating room students who were undertaking their practicum and internship in the operating room environment. The sample size was estimated to be 266 participants, based on the standard deviation (SD) of the operating room climate assessment variable in Qiyami Keshtgar and Hosseini Zijood's research (10), with an effect size of 0.1 and a significance level of 0.05, utilizing Equation 1. All students from the third semester onwards were included in the study via census sampling.

Equation 1
$$n = \frac{N \times \sigma^2 \times Z^2_{1-\frac{\alpha}{2}}}{(N-1) \times d^2 + \sigma^2 \times Z^2_{1-\frac{\alpha}{2}}}$$

$$N = 266,\ \sigma = 14.32,\ d = 0.1,\ \alpha = 0.05$$

The inclusion criteria included a willingness to participate in the study and the completion of at least one operating room internship credit. Consequently, students in their first and second semesters were excluded from the research. The exclusion criteria included incomplete questionnaires (more than 20% of questions unanswered) and students who were transfer or guest students.

Instruments

The Iranian Measure of Operating Theater Educational Climate (IMOTEC), a localized version of the Surgical Theater Educational Environment Measure (STEEM), was utilized as the assessment instrument. This questionnaire comprises two sections. The first section gathers demographic information (including age, gender, and academic semester). The second section consists of 30 questions. The quality of the educational climate is assessed across five domains: Coaching (14 questions), interaction with operating room staff (5 questions), learning opportunities (5 questions), workload (3 questions), and support (3 questions).

The IMOTEC questionnaire uses a five-point Likert scale, ranging from 0 to 4 (0 = strongly disagree, 1 = almost disagree, 2 = almost agree, 3 = agree, and 4 = strongly agree). This 30-item questionnaire has a total score range of 0 to 120. The scoring for the educational climate is evaluated as follows: A score in the first range (0-29.9) indicates a highly unfavorable educational climate; a score in the second range (30-59.9) signifies an unfavorable climate; a score in the third range (60-89.9) represents a favorable climate; and a score in the fourth range (90-120) denotes a highly

favorable educational climate. The validity and reliability of the IMOTEC questionnaire were examined in a study by Karami et al., in such a way that content validity confirmed its validity, and its reliability was reported as 0.85 using Cronbach's alpha (11). In the present study, the reliability of each dimension and the total scale was also calculated, yielding a Cronbach's alpha of 0.93. Additionally, the Cronbach's alpha values for the dimensions of coaching, interaction with operating room staff, learning opportunities, workload, and support were 0.97, 0.83, 0.76, 0.71, and 0.84, respectively.

Data Collection Methods

The researcher personally introduced themselves to the students, explained the study's purpose and methodology, and then provided questionnaires to those willing to participate. Students completed the questionnaires self-reportingly in the presence of the researcher. Necessary explanations regarding data confidentiality and non-judgment were provided to the participants to control for confounding factors.

Central tendency and dispersion indices, along with frequency tables, were utilized for data analysis. Due to the non-normal distribution of some variables, non-parametric tests, such as Mann-Whitney and Kruskal-Wallis, were employed. Ultimately, data were analyzed using SPSS version 26 (IBM Corporation, Armonk, NY).

Results

A total of 266 individuals participated in the present study [189 women (71.1%) and 77 men (28.9%); mean age = 21.68 ± 1.25 years]. Among them, 161 (60.5%) were operating room students and 105 (39.5%) were anesthesiology students, ranging from the third to the eighth academic semester (Appendix, Table 1). The assessment of the operating room educational climate revealed that the mean score of the operating room educational climate from the students' perspectives was 68.68 ± 19.48, indicating a favorable level (Appendix, Table 2). Additionally, analyses showed that 57.5% (n = 153) of the students believed that the operating room educational climate was at a favorable level (Appendix, Table 3).

According to the Kolmogorov-Smirnov test results, the total score of the operating room educational climate is a non-normally distributed variable (P = 0.002). Consequently, the accuracy of all hypotheses was examined using non-parametric tests. Accordingly, no significant association was observed between gender and the mean score of the operating room educational climate (P = 0.799), whereas a significant association was found between age and the mean score of the operating room educational climate (P = 0.026). Moreover, a significant association was observed between academic semester and the mean score of the operating room educational climate (P < 0.001) (Table 1).

Data analysis revealed a significant difference in the mean scores of the operating room educational climate across various hospitals in the province (P < 0.001). Hazrat-e-Rasoul Hospital in Ferdows recorded the highest mean score, while Imam Reza Hospital in Birjand had the lowest.

A significant difference was observed in the mean scores of the coaching domain across various hospitals in the province (P < 0.001). The highest mean score for this domain, from the students' perspectives, was reported at Chamran Hospital in Ferdows. Similarly, a significant difference was found in the interaction with operating room staff domain among the province's hospitals, with Hazrat-e-Rasoul Hospital in Ferdows exhibiting the highest mean score. Furthermore, significant differences were identified in the learning opportunities domain across the hospitals (P = 0.033), where Chamran Hospital in Ferdows had the highest mean score.

However, no significant difference was noted in the mean scores of the workload domain among various hospitals (P = 0.214), though Hazrat-e-Rasoul Hospital in Ferdows showed the highest mean in this domain. Finally, no significant difference was observed in the support domain across the hospitals (P = 0.949). Nevertheless, Imam Khomeini Hospital in Tabas recorded the highest mean score in this domain (Table2).

In the present study, a significant difference was observed in the mean scores of the operating room educational climate between anesthesiology and operating room fields of study (P < 0.001). The operating room field of study reported a higher mean score of 72.43 ± 16.25, indicating that operating room students perceived the operating room climate as more favorable than anesthesiology students. Moreover, a significant difference was observed between operating room and anesthesiology fields of study in the coaching domain, with operating room students evaluating the operating room educational climate to be more favorable (mean score = 10.82 ± 37.88).

In the interaction with operating room domain staff, no significant difference was found between the two fields of study (P = 0.875). Operating room and anesthesiology fields of study also exhibited a significant difference in the learning opportunities domain, with operating room students again assessing the educational climate more positively (mean score = 9.78 ± 3.99). However, there were no significant differences in the workload (P = 0.209) and support (P = 0.073) domains between the two fields of study. With the exception of workload, operating room students rated the operating room educational climate better than anesthesiology students in all other domains (Table 3).

No significant difference was found in the mean total score of the operating room educational climate based on the type of operating room across the province's hospitals (P = 0.248), though the highest mean belonged to the ophthalmology operating room. Similarly, within the coaching domain, there was no significant difference among the hospital operating room types (P = 0.328); however, the neurosurgery operating room had the highest mean. No significant difference was observed in the interaction with operating room staff domain across operating room types (P = 0.598), with the ophthalmology operating room again showing the highest mean in this domain. Similarly, in the learning opportunities domain, no significant difference was observed among hospital operating room types (P = 0.624), yet the ophthalmology operating room had the highest mean. Regarding the workload domain, no significant difference existed between operating room types either (P = 0.886); however, the highest mean in this domain belonged to the urology operating room. Finally, in the support domain, there was no significant difference among hospital operating room types (P = 0.968), though the neurosurgery operating room demonstrated the highest mean in this domain (Table 4).

Discussion

The present study aimed to assess the operating room educational climate in teaching hospitals from the perspectives of operating room and anesthesiology students at Birjand University of Medical Sciences in 2023. The results showed that the mean total score of the IMOTEC questionnaire was 68.68 ± 19.48. Given the IMOTEC questionnaire's score range of 60-89.9, this score indicates a favorable climate, with over 57% of students perceiving the operating room educational climate as favorable. No significant association was found between gender and the mean score of the operating room educational climate. However, age and academic semester exhibited significant relationships with the mean score of the operating room educational climate. Moreover, the results revealed significant differences in the mean scores of various dimensions of the educational climate, as well as the mean total score of the operating room educational climate, across different hospitals in the province. Notably, Hazrat-e-Rasoul Hospital in Ferdows had the highest mean score, while Imam Reza Hospital in Birjand had the lowest.

Compared to previous domestic studies that utilized the IMOTEC questionnaire (10, 12), the mean scores in the current research were lower than those reported in the aforementioned studies (10, 12). However, the findings remain within the favorable range according to the questionnaire's classification, which aligns with existing literature.

Furthermore, the coaching domain obtained the highest score in this study, consistent with the findings of the previously mentioned research (10, 12).

Some studies utilizing different instruments to assess the operating room educational climate (1, 13, 14) align with the findings of the present research. Afrazandeh et al. reported students' favorable perspectives toward the learning environment, with findings indicating a positive attitude toward instructors (13). Similarly, Faghani et al.'s study, which investigated the educational climate from the perspectives of all students in the Faculty of Nursing, Midwifery, and Paramedicine, concluded that the overall educational climate was favorable based on the calculated total score (14). Additionally, in a study, Nasiri Ziba et al. reported a favorable quality of the educational environment from the perspectives of undergraduate operating room students (1).

The majority of students at Ardabil University of Medical Sciences across various educational groups (residents, operating room, and anesthesiology) assessed the operating room educational climate as moderate, with no specific domains deemed favorable. They attributed this perception to factors, such as non-educational staff behavior and perspectives, confusion in learning educational content, students' insufficient self-confidence, and a lack of collaborative and respectful atmosphere from physicians (15), which contradict the present study findings. Similarly, Elebute et al. reported that most surgical residents were

dissatisfied with their operating room educational climate (16).

In the present study, a significant relationship was observed between age and the total score of the operating room educational climate, which aligns with the findings of Kamali et al.'s study (12).

In the present study, students in lower academic semesters (3, 4, and 5) held more positive perspectives toward the educational climate compared to their peers in higher semesters. This finding aligns with Afrazandeh et al.'s research (14). Conversely, Mahoney et al.'s study reported greater satisfaction with the operating room environment among senior surgical interns than among junior students (17).

The results of Qiyami Keshtgar and Hosseini Zijood's research revealed a significant relationship between academic semester and the students' perspectives so that students in higher academic semesters perceived support in the operating room environment as more favorable, while those in lower semesters reported the coaching domain as more favorable (10).

Based on the present study's findings, the mean score of the operating room educational climate was higher among female students compared to male students; however, this difference was not statistically significant, which aligns with the results reported by Mohammadi et al. (18). In the present research, a significant difference was observed in the mean score of the operating room educational climate across various hospitals within the province. Conversely, no significant difference was found in the mean total score of the operating room educational climate based on the operating room type within the province's hospitals. The findings of Qiyami Keshtgar and Hosseini Zijood's research indicated no significant difference in the assessment of the operating room educational climate among the educational-therapeutic centers of Zahedan University of Medical Sciences (10), which is not consistent with the results of the current study.

Variations in research findings can be attributed to several factors, including the diversity of educational groups studied, the use of different research instruments, disparities in the facilities and resources of clinical-educational environments, inconsistencies in educational programs and teaching techniques employed by clinical instructors, the presence of multiple instructors, and differences in students' attitudes, motivation, and scientific and practical skills. Therefore, it is recommended that further studies be conducted using other standardized instruments for assessing the educational climate, and that these studies include other student groups present in the operating room, such as resident students. Additionally, it is suggested that research be undertaken to investigate the operating room educational climate both with and without the presence of an instructor (e.g., in preceptorship or mentorship models).

One limitation of the present study was gaining the trust of students for questionnaire completion. They were assured that confidentiality would be maintained and their responses would not affect their evaluations. Additionally, due to the large number of questionnaire items, sufficient time was allocated to students to ensure accurate responses. Despite these limitations, the current study assessed the perspectives of operating room and anesthesiology students within multiple hospitals at the university level.

Conclusion

The findings of the current study demonstrate that most operating room and anesthesiology students at Birjand University of Medical Sciences perceive the operating room educational climate as favorable.

Supplementary Material(s): is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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References

1. Nasiri Ziba F, Fatollahi S, Hanani S. Evaluation of difference between operating room men and women student's views about quality of educational environment in Iran university of science in the year 2016-2017. Paramed Sci Military Health. 2017;12(3):29-34. [In Persian].
2. Tazakori Z MS, Mobaraki N, Dadashi L, Ahmadi Y, Shokri F, et al. Factors affecting on quality of clinical education from perspectives of operating room students. Journal of Health and Care. 2015;17(2):128. [In Persian].

3. Pournamdar Z SH, Shahrakipoor M, Sohrabzade S. Nurse And Midwifery Students' satisfaction Of Clinical Education In Hospitals Of Zahedan. 2015. 2015;7(2):45-51. doi:10.18869/acadpub.rme.7.2.45.
4. Soemantri D, Herrera C, Riquelme A. Measuring the educational environment in health professions studies: A systematic review. Medical teacher. 2010; 32(12): 947-52. doi: 10.3109/01421591003686229. [PMID: 21090946]
5. Meyer R VSS, Prakaschandra R. The operating room as a clinical learning environment: An exploratory study. Nurse education in practice. 2016;18:60-72. doi:10.1016/j.nepr.2016.03.005. [PMID: 27235567]
6. Zadi O, Nasiri E, Bazari Z, Asadpour H. Factors affecting on quality of clinical education from perspectives of Operating room and Anesthesiology students at Mazandaran University of medical sciences in 2018. Educ Strategy Med Sci. 2020; 13 (4):335-41. [In Persian]
7. Tolyat M, Taherirad M, Pirannezhad R. The challenges of clinical education in operating room and anesthesia Students of Birjand University of Medical Sciences. Development Strategies in Medical Education. 2020; 7(1): 52-60. doi: 10.29252/dsme.7.1.52. [In Persian].
8. Negash TT, Eshete M, Hanago GA. Anesthesia students' perception of the educational environment and academic achievement at Debre Tabor University and University of Gondar, Ethiopia: a comparative cross-sectional study. BMC Medical Education. 2022;22(1):552. doi:10.1186/s12909-022-03611-4. [PMID: 35840966] [PMCID: PMC9287941]
9. Sameri M, Shakibi A, Alilu L. Evaluation Of Clinical Education Environment Based On PHEEM Model From Residents'viewpoints In Urmia University Of Medical Sciences In 2020. Nursing And Midwifery Journal. 2021;19(1):9-12. [In Persian].
10. Ghiami Keshtgar N, Shafiei F, Hosseini Zijoud S. Study of educational environment of operating room in teaching hospitals from learners' viewpoints in Zahedan University of Medical Sciences. Research in Medical Education. 2023;14(4):25-33. [In Persian].
11. Karami S, Hannani S, Sadati L, Rahimzadeh M. Psychometric evaluation and localization of STEEM tool for surgical technologists in Iran. The Journal of Medical Education and Development. 2019; 13(4): 345-57. doi: 10.18502/jmed.v13i4.527.[In Persian].
12. Kamali N, Asadi F, Mohammadi S, Khatib K, Gholami S. The role of operating room educational climate in the moral distress of operating room technology students: A cross-sectional study. Journal of Medical Education Development. 2024;17(55): 154-63. doi:10.61186/edcj.17.55.154.
13. Afrazandeh S, Bakhshizadeh F, Madah R, Khosravi M, Yazdanparast E. Relationship between Learning Environment with Civic-Educational Behaviors from the Students ' viewpoint. Research in Medical Education. 2022;14(1):1-12. doi:10.52547/rme.14.1.1.
14. Faghani M, Jouybari L, Sanagoo A, Mansourian A. The Perspectives of students about educational climate of Golestan University of Medical Sciences In 2010. Journal of Medical Education Development. 2014;6(12):43-50. [In Persian]
15. Ghaheri F, Mirzaei K, Naderi F, Mohammadi M. Determining the Educational Climate of the Operating Rooms of Therapeutic Educational Centers from the Perspective of Students of Ardabil University of Medical Sciences in 2023. Journal of Health and Care. 2024;26(1):87-97. [In Persian].
16. Elebute OA, Sule S, Mofikoya BO, Jeje EA, Atoyebi OA. Surgical resident doctors' perception of their training using Surgical Theatre Educational Environment Measure (STEEM) tool in postgraduate surgical residency training institutions in Nigeria. Nigerian Postgraduate Medical Journal. 2022;29(3):256-260. doi:10.4103/npmj.npmj_91_22. [PMID: 35900463]
17. Mahoney A, Crowe PJ, Harris P. Exploring Australasian surgical trainees' satisfaction with operating theatre learning using the 'surgical theatre educational environment measure. ANZ journal of surgery. 2010;80(12):884-9. doi:10.1111/j.1445-2197.2010.05430.x. [PMID: 21114727]
18. Mohammadi S, Kenarkoohi A, Rostami A, Bastami M, Rezagholi P, Sadeghi M, et al. A DREEM-based Assessment of the Educational Environment as Perceived by Paramedical Students. Journal of Health Sciences & Surveillance System. 2024;12(3):271-9. doi: 10.30476/jhsss.2023.96985.1689.

Table 1. The association between the operating room educational climate and the students' demographic characteristics using Mann-Whitney and Kruskal-Wallis tests

Variable	Group	Mean (SD)	First Quartile	Median	Third Quartile	Test Statistic	P-Value
Gender	Male	68.32 (18.64)	58	71	81	-0.245	0.799
	Female	68.83 (19.86)	57.5	70	82.5		
Age (year)	Less than 20	72.40 (12.71)	65	75	81	1.303	0.521
	20-23	68.19 (20.17)	57	69	82		
	More than 23	67.44 (21.73)	51.8	70	85		
Semester	3	89.50 (9.35)	82	90.5	97.8	44.352	< 0.001
	4	75.44 (13.65)	66	78	84		
	5	81.93 (17.61)	72	81	97.3		
	6	60.81 (20.86)	47	61	77.8		
	7	63.73 (15.04)	53	63	78		
	8	67.02 (19.26)	5	67.5	80.8		

SD: Standard deviation

Table 2. Comparison of the mean scores of the Iranian Measure of Operating Theater Educational Climate (IMOTEC) domains across various hospitals in the province using the Kruskal-Wallis test

Domain	Hospital Name	Mean (SD)	First Quartile	Median	Third Quartile	Test Statistic	P-Value
Total score	Chamran	80.39 (10.63)	74	80.5	88	37.789	< 0.001
	Hazrat-e-Rasoul	85.17 (9.56)	75	84.5	95.5		
	Valiy-e-Asr	58.58 (20.22)	35	61	74		
	Razi	63.72 (25.54)	47	71	80		
	Imam Reza	63.29 (17.80)	43.3	66	78		
	Shohaday-e-Qaen	69.89 (18.15)	57	68	82		
	Imam Khomeini, Tabas	76.52 (13.01)	67.5	76	85.5		
Coaching	Chamran	44.53 (5.39)	43.3	47	48	64.806	< 0.001
	Hazrat-e-Rasoul	44.17 (5.78)	40.5	46.5	48		
	Valiy-e-Asr	25.82 (12.84)	16.5	26	40		
	Razi	31.74 (16.39)	18	39	45		
	Imam Reza	31.64 (12.74)	18	36	42		
	Shohaday-e-Qaen	35.06 (10.37)	27	35	46		
	Imam Khomeini, Tabas	41.72 (6.07)	37	43	47.5		
Interaction with operating room staff	Chamran	13.28 (4.74)	10	14	17	24.831	< 0.001
	Hazrat-e-Rasoul	16.83 (2.56)	14	17	19.3		
	Valiy-e-Asr	10.69 (5.29)	5.5	12	15		
	Razi	10.13 (5.07)	7	10	15		
	Imam Reza	10.48 (3.79)	7.3	10	13		
	Shohaday-e-Qaen	12.69 (3.85)	10	12	16		
	Imam Khomeini, Tabas	10.38 (4.68)	7	10	13		
Learning opportunities	Chamran	10.17 (3.63)	7.3	10	12	13.708	0.033
	Hazrat-e-Rasoul	8.67 (3.88)	5	10.5	11.3		
	Valiy-e-Asr	8.48 (3.91)	5	9	11		
	Razi	9.08 (5.05)	3	9	13		
	Imam Reza	8.12 (4.19)	5	8	12		
	Shohaday-e-Qaen	8.97 (4.67)	6	9	12		
	Imam Khomeini, Tabas	11.4 (2.93)	9.5	11	13.5		
Workload	Chamran	5.03 (2.85)	3	4	7	8.344	0.214
	Hazrat-e-Rasoul	8.33 (3.83)	3.8	10	11.3		
	Valiy-e-Asr	6.76 (2.62)	5	6	9		
	Razi	5.67 (3.29)	3	6	8		
	Imam Reza	5.96 (2.47)	4	6	7		
	Shohaday-e-Qaen	5.98 (3.42)	3	5	8		
	Imam Khomeini, Tabas	5.52 (3.39)	3	6	9		
Support	Chamran	7.39 (1.74)	6.3	7	9	1.651	0.949
	Hazrat-e-Rasoul	7.17 (2.79)	5.8	7.5	9.3		
	Valiy-e-Asr	6.82 (2.53)	6	7	8		
	Razi	7.10 (2.14)	6	7	9		
	Imam Reza	7.25 (2.43)	6	7	9		
	Shohaday-e-Qaen	7.19 (2.22)	6	7	9		
	Imam Khomeini, Tabas	7.55 (1.84)	6	8	8.5		

SD: Standard deviation

Table 3. Comparison of the mean scores of the Iranian Measure of Operating Theater Educational Climate (IMOTEC) domains across various hospitals in the province using the Kruskal-Wallis test

Domain	Hospital Field of Study	Mean (SD)	First Quartile	Median	Third Quartile	Test Statistic	P-Value
Total score	Anesthesiology	62.93 (22.49)	45	64	80	-3.499	< 0.001
	Operating room	72.43 (16.25)	61	74	82.5		
Coaching	Anesthesiology	30.29 (13.97)	18	30	43.5	-4.441	< 0.001
	Operating room	37.88 (10.82)	31.5	42	47		
Interaction with operating room staff	Anesthesiology	11.29 (5.13)	7.5	12	15	-0.157	0.875
	Operating room	11.68 (4.26)	9	11	15		
Learning opportunities	Anesthesiology	8.22 (4.58)	4	8	11	-3.011	0.003
	Operating room	9.78 (3.99)	7	10	12		
Workload	Anesthesiology	6.24 (3.29)	4	6	9	-1.258	0.209
	Operating room	5.68 (2.92)	3	6	8		
Support	Anesthesiology	6.89 (2.41)	6	7	8.5	-1.794	0.073
	Operating room	7.42 (2.02)	6	8	9		

SD: Standard deviation

Table 4. Comparison of mean scores of the operating room educational climate based on operating room types at hospitals affiliated with Birjand University of Medical Sciences Using the Kruskal-Wallis test

Domain	Operating Room Type	Mean (SD)	First Quartile	Median	Third Quartile	Test Statistic	P-Value
Total score	Orthopedics	67.54 (18.12)	57	68	81	6.656	0.248
	Neurology	69.51 (25.58)	56	76	85		
	Gynecology	66.29 (19.75)	54	65	82.5		
	General	69.21 (15.78)	60	68	81		
	Ophthalmology	77.95 (12.11)	70.8	76.5	90.8		
	Urology	68.83 (18.62)	53.8	75.5	80.5		
Coaching	Orthopedics	34.54 (12.44)	25	38	46	5.787	0.328
	Neurology	35.43 (15.54)	26	42	47		
	Gynecology	32.54 (13.55)	22	34	44.5		
	General	35.30 (12.07)	30	35	42.5		
	Ophthalmology	40.80 (7.72)	36.8	42.5	47		
	Urology	35.72 (10.28)	24.5	36	47		
Interaction with operating room staff	Orthopedics	11.22 (4.12)	8	11	15	3.670	0.598
	Neurology	11.11 (5.28)	8	11	16		
	Gynecology	11.51 (5.07)	7	13	16		
	General	12.12 (3.97)	9	13	15		
	Ophthalmology	13.10 (3.82)	9.3	12.5	17		
	Urology	11.28 (5.41)	8	9.5	16.5		
Learning opportunities	Orthopedics	8.67 (4.29)	5	9	12	3.496	0.624
	Neurology	9.81 (5.28)	5	9	14		
	Gynecology	9.25 (3.69)	7	10	12		
	General	8.97 (3.86)	6.5	10	11		
	Ophthalmology	10.25 (3.69)	8	11	12		
	Urology	8.78 (4.83)	4.5	9	12.3		
Workload	Orthopedics	2.86 (2.80)	4	6	7	1.720	0.886
	Neurology	5.81 (3.39)	3	6	8		
	Gynecology	5.85 (3.01)	3	6	8.5		
	General	5.48 (2.93)	3	6	7		
	Ophthalmology	6.55 (3.46)	3.3	6	10		
	Urology	6.56 (3.76)	3.8	5.5	10		
Support	Orthopedics	7.26 (2.19)	6	7	9	0.931	0.968

	Neurology	7.36 (2.01)	6	7	9		
	Gynecology	7.15 (2.27)	6	7	9		
	General	7.33 (2.37)	6	8	9		
	Ophthalmology	7.24 (1.80)	6	7.5	8.8		
	Urology	6.50 (2.66)	4.8	7.5	8.3		

SD: Standard deviation

Appendix 1. Determining the frequency of participants' demographic variables

Variable	Group	Frequency (%)
Gender	Male	77 (28.9)
	Female	189 (71.1)
Academic semester	3	10 (3.8)
	4	79 (29.7)
	5	14 (5.3)
	6	100 (37.6)
	7	11 (4.1)
	8	52 (19.5)
Operating room type	Orthopedics	87 (32.7)
	Neurology	47 (17.7)
	Gynecology	61 (22.9)
	General	33 (12.4)
	Ophthalmology	20 (7.5)
	Urology	18 (6.8)
Field of study	Anesthesiology	105 (39.5)
	Operating room	161 (60.5)
Hospital	Chamran	36 (13.5)
	Hazrat-e-Rasoul	6 (2.3)
	Valiy-e-Asr	33 (12.4)
	Razi	39 (14.7)
	Imam Reza	56 (21.1)
	Shohaday-e-Qaen	67 (25.2)
	Imam Khomeini, Tabas	29 (10.9)
Age (year)	Less than 20	43 (16.2)
	20-23	168 (63.4)
	More than 23	54 (20.4)

Appendix 2. Determination of central tendency and dispersion indices of the operating room educational climate domains from the students' perspectives

Domain	Mean (SD)	Minimum	Maximum	First Quartile	Median	Third Quartile
Coaching	34.88 (12.69)	0	48	26.8	39.5	46
Interaction with operating room staff	11.52 (4.62)	0	20	8	11	15
Learning opportunities	9.16 (4.29)	0	20	6	9	12
Workload	5.90 (3.08)	0	12	3	6	8
Support	7.21 (2.19)	0	12	6	7	9
Total score	68.68 (19.48)	0	111	58	70	82

SD: Standard deviation

Appendix 3. Frequency of the operating room climate assessment status from the students' perspectives

Operating Room Climate Assessment	Frequency (%)
Highly unfavorable	7 (2.6)
Unfavorable	70 (26.3)
Favorable	153 (57.5)
Highly favorable	36 (13.5)

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Original Article

Relationship Between Learning Approaches and Critical Thinking Disposition Among Medical Students

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Abstract

Background: Effective learning and strong critical thinking are vital for health sciences students navigating an evolving field. This underscores the importance of understanding how their learning approaches relate to their critical thinking tendencies in health sciences education. However, variations in these skills among students and the challenges in applying knowledge in professional settings highlight the need for focused investigation within specific educational contexts.

Objectives: This study evaluated the learning approaches and critical thinking dispositions of medical students at Sirjan University of Medical Sciences to inform educational enhancement.

Methods: This descriptive-analytical study examined critical thinking dispositions and learning approaches among 310 students. Data were collected via questionnaires. Independent samples t-tests and Pearson correlations were used for data analysis.

Results: The mean score for critical thinking disposition indicated a moderate tendency toward critical thinking. Creativity was related to gender ($p < 0.001$), as was the strategic learning approach ($p < 0.001$). Deep and strategic learning approaches showed significant positive correlations with critical thinking disposition ($p < 0.001$). The surface approach showed a weak negative correlation with critical thinking disposition ($p < 0.001$).

Conclusion: Transforming teaching and evaluation approaches may enhance the effectiveness of the deep learning approach. Active and innovative teaching strategies can increase students' motivation and critical thinking skills.

Keywords: Learning Approaches; Critical Thinking Disposition; Deep Approach; Surface Approach; Strategic Approach

Background

Higher education, as a pivotal institution for a nation's comprehensive development, must equip learners with the necessary knowledge, attitudes, and skills while fostering insight that enables lifelong learning and active participation in development and personal growth (1). Consequently, one of the aims of universities is to enhance the quality of education and students' academic success, as poor performance incurs significant financial and intangible costs for both the institutions and the students themselves (2). Research has consistently demonstrated the fundamental role of critical thinking and learning approaches in student success, with the development of these skills during education directly impacting the quality of learning (3). Moreover, lifelong learning necessitates that students and graduates possess critical thinking skills and the ability to learn independently, thereby fostering their continuous professional development and enabling them to emerge as informed, skilled, and actively contributing members of society (4). To this end, focusing on students' learning processes is crucial for improving their educational experience. However, observations at the university level suggest that many

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graduates struggle to apply the knowledge they have acquired in professional settings. Furthermore, empirical evidence suggests variations in these skill levels among university students, with some failing to acquire them adequately (3, 5, 6), leading to unforeseen challenges, lack of engagement, and insufficient development of necessary academic capabilities during their studies (7), hindering their ability to utilize knowledge in real-life and professional contexts post-graduation.

This may be due to students memorizing material rather than engaging in meaningful learning (8). For academic and professional success, students must understand their learning and study skills, as well as their academic strengths and weaknesses, learning preferences, and the distinction between surface and deep learning. They should adopt deep, meaningful learning methods (9) and cultivate key skills, such as logical and critical thinking—the abilities to analyze, synthesize, and evaluate (10).

Prior research on this topic, conducted in various countries, along with its findings, highlights the importance of this issue, particularly in higher education. Research evidence suggests that critical thinking and study process strategies, as cognitive variables, make unique contributions (11). However, domestic research on this topic is limited and often examines these variables in isolation. Therefore, it is essential to investigate students' learning approaches and critical thinking dispositions as key factors in the learning process, particularly the inclination towards analytical and critical thought, defined as the intrinsic motivation for critical thinking when facing problems (12).

Research on critical thinking dispositions in Iran is limited and has predominantly focused on cognitive skills. Existing studies show varied results, with some indicating low to moderate critical thinking dispositions among students at different levels, suggesting a less than satisfactory situation (13-16). Higher education is expected to equip students with critical thinking skills for analytical problem-solving (17). Therefore, insight and awareness of students' learning approaches and their tendency towards critical thinking, and making decisions to improve the teaching-learning process based on this insight, are beneficial (18).

Therefore, considering the present study's aim to investigate the relationship between learning approaches and critical thinking dispositions among medical students at Sirjan University of Medical Sciences, understanding the status and correlation of these factors can assist educational planners in promoting critical thinking and deep learning approaches within this student population.

Objectives

This research aims to evaluate the current state of learning approaches and critical thinking dispositions among medical students at Sirjan University of Medical Sciences, with the intent of informing and enhancing higher education outcomes within the medical sciences.

Methods

Design and Setting(s): This research is a descriptive-analytical study employing a cross-sectional method, aimed at investigating the relationship between learning approaches and dispositions toward critical thinking among students at Sirjan University of Medical Sciences in 2024.

Participants and Sampling: A sample of 310 individuals was recruited for this study using a proportional stratified random sampling method. This sample size was calculated based on considerations similar to those in a prior study (19), with an allowance of 10% for anticipated attrition.

The participants were selected proportionally from the three faculties within the university to ensure representation: approximately 12.26% from the Faculty of Medicine (38 students), 51% from the Paramedical Faculty (158 students), and 36.77% from the Faculty of Nursing and Midwifery (114 students). Students were randomly selected from within each faculty. The inclusion criterion for the study was all undergraduate students who had completed at least one semester of their studies, as well as those who were willing to participate in the research and answer the questions. The exclusion criteria were incomplete questionnaires, first-semester students, guest students, and students who were unwilling to cooperate in the research.

Tools/Instruments: After obtaining the necessary permissions from the faculty and explaining the project's objectives to the students, the confidentiality of the responses was emphasized, and verbal consent was obtained from them. The questionnaires were then distributed among the students by a research assistant at the faculty location and collected upon completion. For data collection, a) the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) by Biggs et al. (2001), and b) the Ricketts Critical Thinking Disposition Inventory (CTDI) were used.

a) the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) by Biggs et al. (2001), which includes 32 items, measures three approaches: deep,

surface, and strategic. The deep approach (13 items), strategic approach (11 items), and surface approach (8 items) are measured on a five-point Likert scale, ranging from "strongly agree" to "strongly disagree". The scores for each approach are obtained by summing the scores of the items in that approach. The reliability and validity of the questionnaire have been confirmed in various studies. Cronbach's alpha in the study by Mehdinezhad and Esmaeeli was obtained as 0.84 (20). In this study, the Approaches questionnaire had a Cronbach's alpha of 0.74.

b) The Ricketts Critical Thinking Disposition Inventory (CTDI): The critical thinking questionnaire was designed by Ricketts and has three subscales. The first part includes 11 questions to measure the creativity scale, the second part includes 9 questions regarding the perfectionism scale, and the third part includes 13 questions for the commitment scale, which are scored based on a 5-point Likert scale (strongly disagree to strongly agree) (21). The score of each subscale is obtained by summing the scores of the items related to each subscale, and the total score of the tendency to critical thinking is obtained by summing the scores of the three subscales, which can be determined based on the mean total score, strong, moderate, and weak tendencies. In this way, a score of 135.31 and above describes a strong tendency.

A score of 108.91 to 135.30 indicates a moderate tendency, and a score of 108.90 and below indicates a weak tendency towards critical thinking. Ricketts (2003) administered the critical thinking disposition questionnaire to 60 second-year agricultural students in order to normalize it. The reliability coefficients for the subscales were reported as follows: creativity subscale, 0.75; perfectionism subscale, 0.57; and commitment subscale, 0.86. Furthermore, given that this scale was developed based on the original work by Fasion (1990), its construct validity has also been confirmed (21). The reliability and validity of the Ricketts Critical Thinking Disposition Inventory (CTDI) have been evaluated in Iran; Pakmehr et al. investigated the psychometric properties of the Persian version of the CTDI among high school students in Mashhad (22). In this study, the Critical Thinking Dispositions Questionnaire demonstrated a Cronbach's alpha of 0.65.

Data Analysis: In this study, data analysis was performed using SPSS Statistics version 20. Both descriptive and inferential statistics were employed to analyze the collected data. Descriptive statistics included frequencies, percentages, means, and standard deviations. Before inferential analysis, the normality of the data was assessed using the Kolmogorov-Smirnov test. Upon confirming normality, inferential analyses were conducted using independent-samples t-tests and Pearson's correlation coefficient. The significance level for all tests was set at 0.05.

Results

Participants in this study were 310 students from Sirjan University of Medical Sciences. The mean age of the participants was 19.5 years (SD = 0.9), and the sample consisted of 237 females (76.5%) and 73 males (23.5%) students

The mean score for critical thinking disposition was 117.35 ± 13.15, indicating a moderate level of critical thinking disposition. Independent samples t-tests revealed no significant difference in critical thinking disposition between males (mean = 115.48 ± 14.26) and females (mean = 117.91 ± 12.78) ($p = 0.189$). Regarding the components of critical thinking disposition, the mean commitment score for males was 47.43 ± 10.53, and for females, it was 47.91 ± 6.34, with no significant gender difference found ($p = 0.722$). For perfectionism, the mean scores were 28.85 ± 3.68 for males and 28.48 ± 4.67 for females, with no significant gender difference observed ($p = 0.547$). However, a significant difference emerged for creativity, with males scoring a mean of 38.61 ± 6.38 and females scoring a mean of 41.58 ± 6.53 ($p < 0.001$), indicating that females demonstrated significantly higher creativity scores than males. Concerning learning approaches, the most common approaches among students, based on the mean scores, were the deep approach (mean = 46.30 ± 6.49), followed by the strategic approach (mean = 38.92 ± 5.05), and then the surface approach (mean = 26.74 ± 5.38). No significant difference was found between the mean surface approach scores for males (mean = 26.86 ± 5.62) and females (mean = 26.71 ± 5.31) ($p=0.83$). However, a significant difference was observed for the strategic approach ($p < 0.001$), with females scoring higher (mean = 39.52 ± 4.91) than males (mean = 36.94 ± 5.05). Finally, no significant difference was found between the mean deep approach scores for males (mean = 46.07 ± 7.19) and females (mean = 46.36 ± 6.29) ($p=0.743$) (Table 1).

Table 2 presents the correlations between learning approaches and critical thinking disposition among the participating students. The results reveal a significant positive relationship between both deep and strategic learning approaches and critical thinking disposition. Specifically, students who adopt deep and strategic

learning approaches demonstrate a greater propensity for critical thinking.

A significant correlation ($r = 0.608$, $P < 0.001$) was observed between the deep learning approach and critical thinking disposition. Similarly, a positive and significant correlation ($r = 0.544$, $P < 0.001$) was found between the strategic learning approach and critical thinking disposition. Conversely, the surface learning approach demonstrated a significant negative correlation ($r = -0.051$, $P < 0.001$) with critical thinking disposition.

In addition to critical thinking disposition, table 2 also displays correlations between learning approaches and other variables such as commitment, perfectionism, and creativity. The findings indicate that deep and strategic learning approaches are positively associated with commitment and creativity, while the surface approach exhibits a negative relationship with these variables. Specifically, the correlation between Strategic Approach and Creativity was further analyzed by gender. The correlation coefficient for males was 0.394 ($p = 0.001$), and for females, it was 0.483 ($p < 0.001$), suggesting a stronger positive relationship between strategic approach and creativity in females.

Discussion

Research on medical students' learning approaches suggests that while deep learning often correlates with better outcomes, surface, strategic, and deep approaches are present to varying degrees. These approaches are influenced by both educational environments and individual factors, resulting in diverse patterns across universities globally.

Contrasting patterns emerge when examining learning approaches among medical students. Iranian studies (23-25) often indicate a preference for deep learning. However, other Iranian research (20, 26) and some international studies (27) suggest a stronger tendency towards surface learning. Conversely, strategic learning was dominant in other international research (28-30), while deep learning was prominent in another (31). These varied findings highlight the context-specific nature of learning approach adoption in medical education.

Since learning approaches are influenced by the characteristics of the teaching-learning environment and the student's characteristics and perceptions of that situation (32). According to Ramsden (cited in Byrne et al.) (28), factors such as previous educational experiences, students' study orientation, and the characteristics of the educational context and situation, such as teaching and evaluation methods and curriculum, are effective in shaping students' learning approaches. Of course, among the factors that affect learning approaches, the characteristics of the educational situation, particularly teaching and evaluation methods, have the greatest impact on learning approaches (31). Additionally, Entwistle (33) demonstrated the interactive effects on students' learning within the framework of a theoretical model. In this model, he stated that educational and teaching methods directly influence learning approaches.

Teaching and assessment methods significantly influence medical students' learning approaches, with a deep learning approach linked to better outcomes (34-36). Strategies promoting deep learning include group work and qualitative assessments. However, the significant presence of surface and strategic approaches suggests that current methods may inadvertently encourage them, possibly due to traditional lectures and score-focused evaluations.

This study found a significant difference ($p < 0.001$) only in the strategic learning approach between genders, with females scoring higher, aligning with some prior research (20) but contrasting with others (34). The lack of significant gender differences in surface and deep approaches suggests that shared educational context and students' perceptions of it are primary influences on these approaches. Given the uniform curriculum, teaching, and evaluation methods for both male and female students, the absence of significant gender variation in surface and deep learning is logical.

The study found that medical students' critical thinking disposition was average, consistent with Shokornia et al. (37). International research shows varied critical thinking tendencies among university students, with many exhibiting a low disposition (38, 39). Similarly, nurses (40) and other student populations (41, 42) often exhibit a hesitant disposition, highlighting the need for interventions such as problem-based learning (40). The educational environment has a significant influence on critical thinking (43, 44), which is also closely linked to educational quality and student performance (45, 46).

Research (47, 48) highlights the effectiveness of modern teaching techniques in improving these skills. Thus, the relatively lower disposition in this study likely stems from the educational methods employed.

The study found no significant gender difference in critical thinking disposition among students, consistent with other research (38, 39, 49). However, one study reported slightly higher scores for males (50). This lack of difference likely reflects the shared educational

environment and methods for both genders. The prevalent use of traditional lecture-based teaching, which often neglects explicit instruction in critical thinking (13), may contribute to students' moderate disposition towards critical thinking. Modern approaches, such as the flipped classroom, are suggested to better cultivate this skill (51), particularly in medical education. This study found no significant gender differences in the use of deep and surface learning approaches; however, female students were significantly more likely to favor the strategic approach. Other research on gender and learning approaches is inconsistent; one study found no difference (26), while another reported females using the surface approach more (31). Researchers (52) suggest cultural context and societal expectations may explain these discrepancies, highlighting the need for further cross-cultural research.

The study reveals a positive and significant correlation between learning approaches and critical thinking disposition, particularly between strategic and deep approaches and this disposition. This aligns with prior research (11, 14, 53) highlighting a link between deep learning and critical thinking. The significant association is logical given the shared characteristics of these learners. Strategic learners, who consciously control their cognitive processes (54), also show a strong relationship with critical thinking disposition, as both involve metacognitive reflection.

This study's reliance on self-report questionnaires presents a common limitation due to potential response bias, as students' perceptions may not fully represent their actual critical thinking abilities or behaviors. Additionally, the cross-sectional design prevents the establishment of causality; while correlations were found between critical thinking disposition and learning approaches, the direction of influence remains unclear. Future longitudinal studies are necessary to explore these relationships further.

Conclusion

The results of the study showed that all three approaches (deep, strategic, and surface) exist among students, but the average deep learning approach is greater than the strategic approach and the surface approach. Additionally, this study found that students' disposition towards critical thinking was at a moderate level, and a correlation was observed between learning approaches and this disposition. In summary, the results obtained from this research suggest that those responsible for higher education should optimize teaching and evaluation methods. Therefore, it is suggested that by transforming the existing teaching and evaluation approaches, the grounds for strengthening the deep learning approach be provided. It is also suggested that professors make more use of active and modern teaching strategies to increase students' motivation and willingness to apply critical thinking skills.

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Conflict of interests: There is no conflict of interest.

Ethical approval: Ethical approval for this study was obtained from the Ethics Committee of Sirjan School \of Medical Sciences, Sirjan, Iran (Ethical Code: IR.SIRUMS.REC.1403.004). All participants were informed about the study's goals, the privacy of their data, and their right to choose whether or not to participate.

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References

1. Araghiyeh A, Fathi Vajargah K, Barzegar N, Moradi S. The development of human resources in higher education through respecting cultural diversity of the students. Journal of Management and Planning In Educational System. 2011;4(2): 85-99. [In Persian]
2. Farokhi N. The role of educational variables in the academic achievement of graduate students. Journal of Research in Educational Systems. 2016;10(33):73-84. [In Persian]
3. Hyytinen H, Toom A, Postareff L. Unraveling the complex relationship in critical thinking, approaches to learning and self-efficacy beliefs among first-year educational science students. Learning and Individual Differences. 2018;67:132-42. doi:10.1016/j.lindif.2018.08.004.
4. Mohammadi Mehr M, Maleki H, Abbas Pour A, Khoshdel AR. Role of higher education in lifelong learning. Educ Strategy Med Sci. 2011; 4 (2):91-4. [In Persian]
5. Barat Dastjerdi N, Yusofi E. Exploration of Relationship Between Usage of Information and Communication Technology (ICT) Tools and Critical Thinking Desposition Among Distance Education Students. Educational Research. 2017;3(2):47-62. [In Persian]
6. Kalantari M. Developing a Critical Thinking Development Model Based on the Study Approaches and Learning Styles of Students at Guilan Islamic Azad University. Culture in Islamic University. 2020; 9(33): 565-86. [In Persian]
7. Bunce L, Baird A, Jones SE. The student-as-consumer approach in higher education and its effects on academic performance. Studies in Higher Education. 2017;42(11):1958-78. doi:10.1080/03075079.2015.1127908.
8. Zain ZM, Malan INB, Noordin F, Abdullah Z. Assessing student approaches to learning: A case of business students at the Faculty

of Business Management, UiTM. Procedia-Social and Behavioral Sciences. 2013;90:904-13. doi:10.1016/j.sbspro.2013.07.167.
9. Asikainen H, Gijbels D. Do students develop towards more deep approaches to learning during studies? A systematic review on the development of students' deep and surface approaches to learning in higher education. Educational Psychology Review. 2017;29(2):205-34. doi:10.1007/s10648-017-9406-6.
10. Vierra RW. Critical thinking: Assessing the relationship with academic achievement and demographic factors. (Dissertation). Minneapolis, MN, USA: University of Minnesota; 2014.
11. Phan HP. Relations between goals, self-efficacy, critical thinking and deep processing strategies: a path analysis. Educational Psychology. 2009;29(7):777-99. doi:10.1080/01443410903289423.
12. Shakurnia A, Elhampour H, Oraki Kohshour M, Izadpanah S. Investigating the Relationship between Critical Thinking Disposition and Teaching Style of Faculty Members in Ahvaz Jundishapur University of Medical Sciences. Res Med Edu. 2022; 14 (1) :44-53. doi:10.52547/rme.14.1.44. [In Persian]
13. Amini M, Fazlinejad N. Critical thinking skill in Shiraz University of medical sciences students. Hormozgan Med J. 2010;14(3):214-9. [In Persian]
14. Sulaiman WSW, Rahman WRA, Dzulkifli MA. Relationship between Critical Thinking Dispositions, Perceptions towards Teacher, Learning Approaches and Critical Thinking Skills among University Students. The Journal of Behavioral Science. 2012;3(1): 122-33.
15. Duncan DW, Haas R, Ricketts JC. Comparing Critical Thinking Dispositions of Students Enrolled In a College Level Global Seminar Course. Journal of International Agricultural and Extension Education. 2016; 23(2): 39-51. doi: 10.5191/jiaee.2016.23203.
16. Rastjoo S, Sepehr H, Zandvanian A. Critical Thinking Dispositions and relationship: Academic performances among master's degree students at Yazd University. Higher Education Letter. 2016;9(34):171-89. [In Persian]
17. Karimi S, Nasr Isfahani AR, Sharif M. Curriculum Design Requirements and Challenges of the Learning Society Approach. Journal of Education and Learning. 2012;1(2): 143-54. doi:10.5539/jel.v1n2p143.
18. Ra JS, Lim J. Development and evaluation of a video discharge education program focusing on mother-infant interaction for mothers of premature infants. J Korean Acad Nurs. 2012 Dec;42(7):936-46. doi: 10.4040/jkan.2012.42.7.936. [PMID: 23377589]
19. Rastjoo S, Sepehr H, Zandvanian A. Investigating the relationship between critical thinking disposition, learning approaches and academic performance of graduate students of Yazd University. Iranian Higher Education. 2014;6(3):63-84. [In Persian]
20. Mehdinezhad V, Esmaeeli R. Surveying the Relation between Faculty Membersâ Teaching Approaches and Studentsâ Learning Approaches in University of Sistan and Balouchestan. Teaching and Learning Research. 2015;11(2):51-66. [In Persain]
21. Roberts TG, Dyer JE. The Relationship Of Self-Efficacy, Motivation, And Critical Thinking Disposition To Achievement And Attitudes When An Illustrated Web Lecture Is Used In An Online Learning Environment. Journal of Agricultural Education. 2005;46(2):12-23. doi:10.5032/jae.2005.02012.
22. Pakmehr H, Mirdrogi F, Ghanaei A, Karami M. Reliability, Validity and Factor Analysis of Ricketts' Critical Thinking Disposition Scales in High School. Quarterly of Educational Measurement. 2013;4(11):33-54.
23. Fathabadi J, Seif A. Investigating the Effects of Type of Assessment (Essay and Multiple-Choice) on Students' Approaches to Studying and Exam Preparation Strategies between Students with High and Low Academic Achievement. Journal of Educational Sciences, 2008; 14(4): 21-46. doi: 10.22055/edus.2008.15804. [In Persian]
24. Abbaszadeh A, Borhani F, Sabzevari S, Eftekhari Z. The Assessment Methods and its Relationship to Learning Approaches of Nursing Students in Kerman University of Medical Sciences Iran. Strides Dev Med Educ. 2013;10(2): 260-70. [In Persian]
25. Parsa A, Saketi P. Approaches, Learning Outcomes, and Students' Perceptions of the Implemented Curriculum and Academic Period. Journal of Social Sciences and Humanities of Shiraz University. 2017;24(1):1-24. [In Persian]
26. Pirmohammadi GR, Khodaei A, Yousefi H, Shariati F, Dasta M. The Relationship between Thinking Styles and Learning Approaches with Academic Achievement of Male and Female Students. Studies Teaching and Learning. 2010;2(1): 69-94. [In Persian]
27. Ballantine JA, Duff A, Larres PM. Accounting and business students' approaches to learning: a longitudinal study. Journal of Accounting Education. 2008; 26(4): 188-201. doi: 10.1016/j.jaccedu.2009.03.001.
28. Byrne M, Flood B, Willis P. An Inter-Institutional Exploration of the Learning Approaches of Students Studying Accounting. International Journal of Teaching and Learning in Higher Education. 2009;20(2): 155-67.
29. Chonkar SP, Ha TC, Chu SSH, Ng AX, Lim MLS, Ee TX, et al. The predominant learning approaches of medical students. BMC Med Educ. 2018 Jan 18;18(1):17. doi: 10.1186/s12909-018-1122-5. [PMID: 29347934] [PMCID: PMC5774125]
30. Sam L. Relationship Between Learning Approaches and Academic Achievement of Accounting Education Students. International Journal of Scientific and Research Publications (IJSRP). 2020;10(7):919-24. doi:10.29322/IJSRP.10.07.2020.p103103.
31. Peters D, Jones G, Peters J. Approaches to studying, academic achievement and autonomy, in higher education sports students. Journal of Hospitality, Leisure, Sport and Tourism Education. 2007;6(2):16-28. doi:10.3794/johlste.62.132.
32. Ballantine JA, Duff A, Larres PM. Accounting and business students' approaches to learning: A longitudinal study. Journal of Accounting Education. 2008; 26(4): 188-201. doi: 10.1016/j.jaccedu.2009.03.001.
33. Hughes J, Mighty J. Taking stock: teaching and learning research in higher education. Montreal, Quebec: McGill-Queen's University Press; 2010. doi:10.1111/j.1467-9647.2012.00838.x.
34. Mahmoodzadeh A, Javadi A, Mohammadi Y. Relationship between Studying Approaches and Academic Performance in Students of Birjand University of Medical Sciences. Res Med Edu. 2016; 8 (3): 9-16. doi: 10.18869/acadpub.rme.8.3.9. [In Persian]
35. Herrmann KJ, Bager-Elsborg A, McCune V. Investigating the relationships between approaches to learning, learner identities and academic achievement in higher education. Higher Education. 2017;74(3):385-400. doi:10.1007/s10734-016-9999-6.
36. Orsini CA, Binnie VI, Tricio JA. Motivational profiles and their relationships with basic psychological needs, academic performance, study strategies, self-esteem, and vitality in dental students in Chile. J Educ Eval Health Prof. 2018 Apr 19:15:11. doi: 10.3352/jeehp.2018.15.11. [PMID: 29689689] [PMCID: PMC5968222]
37. Shakurnia A, Karami Motlagh M, Oraki koshour M. Critical thinking disposition of postgraduate students of medical school in Ahvaz Jundishapur University of Medical Sciences, in 2017. Educ Strategy Med Sci. 2019; 12 (4): 1-8. [In Persian]

38. Rudd R, Baker M, Hoover T. Undergraduate agriculture student learning styles and critical thinking abilities: Is there a relationship? Journal of Agricultural Education. 2000;41(3):2-12.
39. Bisdorf-Rhoades E, Ricketts J, Irani T, Lundy L, Telg R. Critical thinking dispositions of agricultural communications students. Journal of Applied Communications. 2005; 89(1): 2. doi:10.4148/1051-0834.1300.
40. Mahmoud AS, Mohamed HA. Critical thinking disposition among nurses working in puplic hospitals at Port-Said Governorate. Int J Nurs Sci. 2017 Mar 2;4(2):128-134. doi: 10.1016/j.ijnss.2017.02.006. [PMID: 31406732] [PMCID: PMC6626108]
41. Anajafi F, Zera'at Z, Soltan Mohammadi Z, Ghabchipour K, Kohan F. Critical thinking skills of engineering and human sciences students. Educ Strategy Med Sci. 2009; 2(1): 9-10. [In Persian]
42. Kabeel AR, Mosa Eisa SAE-M. The Correlation of Critical Thinking Disposition and Approaches to Learning among Baccalaureate Nursing Students. Journal of Education and Practice. 2016;7(32):91-103.
43. Ernst J, Monroe M. The effects of environment-based education on students' critical thinking skills and disposition toward critical thinking. Environmental Education Research. 2004;10(4): 507-22. doi:10.1080/1350462042000291038.
44. Stewart S, Dempsey LF. A longitudinal study of baccalaureate nursing students' critical thinking dispositions. J Nurs Educ. 2005 Feb;44(2):81-4. doi: 10.3928/01484834-20050201-07. [PMID: 15719715]
45. Fong CJ, Kim Y, Davis CW, Hoang T, Kim YW. A meta-analysis on critical thinking and community college student achievement. Thinking Skills and Creativity. 2017;26:71-83. doi:10.1016/j.tsc.2017.06.002.
46. Abbasi A, Izadpanah S. The relationship between critical thinking, its subscales and academic achievement of English language course: The predictability of educational success based on critical thinking. Academy Journal of Educational Sciences. 2018;2(2):91-105. doi:10.31805/acjes.445545.
47. Tynjälä P. Traditional studying for examination versus constructivist learning tasks: Do learning outcomes differ? Studies in Higher Education. 1998; 23(2): 173-89. doi: 10.1080/03075079812331380374.
48. Badri Gargari R, Fathi E, Hosseini Nasab SD, Mogaddam M. The Critical Thinking of Students-Teachers in Tabriz Teachers Education College. Modern Psychological Research. 2007;2(7):6-29. [In Persian]
49. Ziaei S, Shahbakhsh J, Mostafaei Darmiany M. Study of relationship between critical thinking skills and reading habits among students of Sistan and Baluchestan. Quarterly Knowledge and Information Management Journal. 2018; 5(2): 79-90. [In Persian]
50. Ghobadian DM. The Comparison of Critical Thinking and Academic self-efficacy among Students at Farhangian University of Khorramabad. Quarterly Journal of Education Studies, 2020; 6(22): 25-36.
51. Dehghanzadeh S, Jafaraghaie F, Khordadi Astane H. The Effect of Flipped Classroom On Critical Thinking Disposition in Nursing Students. Iran J Med Educ. 2018; 18:39-48. [In Persian]
52. Kilic D, Saglam N. Investigating the effects of gender and school type on students' learning orientations. Procedia - Social and Behavioral Sciences. 2010; 2(2): 3378-82. doi: 10.1016/j.sbspro.2010.03.519.
53. Wang JS, Pascarella ET, Nelson Laird TF, Ribera AK. How clear and organized classroom instruction and deep approaches to learning affect growth in critical thinking and need for cognition. Studies in Higher Education. 2015;40(10):1786-807. doi: 10.1080/03075079.2014.914911.
54. Struyven K, Dochy F, Janssens S, Gielen S. On the dynamics of students' approaches to learning: The effects of the teaching/learning environment. Learning and Instruction. 2006;16(4):279-94. doi: 10.1016/j.learninstruc.2006.07.001.

Table 1. Comparison of mean scores for learning approaches and critical thinking disposition by gender using independent samples T-tests

Variable	Minimum Score	Maximum Score	Overall	Male	Female	P-Value*
			Mean (SD)			
Commitment	19	98	47.80 (7.51)	47.43 (10.53)	47.91 (6.34)	0.722
Perfectionism	17	44	28.57 (4.45)	28.85 (3.68)	28.48 (4.67)	0.547
Creativity	19	92	40.89 (6.60)	38.61 (6.38)	41.58 (6.53)	< 0.001
Critical Thinking Disposition	79	175	117.35 (13.15)	115.48 (14.26)	117.91 (12.78)	0.189
Surface Approach	11	39	26.74 (5.38)	26.86 (5.62)	26.71 (5.31)	0.83
Strategic Approach	23	55	38.92 (5.05)	36.94 (5.05)	39.52 (4.91)	< 0.001
Deep Approach	13	65	46.30 (6.49)	46.07 (7.19)	46.36 (6.29)	0.743

*Two independent samples t-test
Minimum and Maximum Scores represent the lowest and highest possible (theoretical) scores for the variables on the measurement instrument used.

Table 2. Correlation between learning approaches and critical thinking disposition in participating students

Variable	Commitment	Perfectionism	Creativity	Critical Thinking Disposition
Deep Approach	0.527*	0.220*	0.459*	0.608*
Strategic Approach	0.483*	0.079	0.482*	0.544*
Surface Approach	-0.109*	-0.326	-0.182	-0.051*

*P-value of Pearson correlation P<0.001

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Original Article

Assessment of Clinical Anxiety and Coping Mechanisms in Dental Undergraduate Students of Zahedan University of Medical Sciences: A Cross-sectional Study

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Abstract

Background: Undergraduate students cope with different aspects of dental learning creating stressful situations automatically.

Objectives: This study aimed to evaluate clinical anxiety and coping mechanisms in students.

Methods: This cross-sectional study involved 218 dental students from the fourth to sixth year at Zahedan University of Medical Sciences. Questionnaires, including the MMMS and CSIS, were utilized to identify anxiety-inducing situations and various coping strategies. Participants assessed their anxiety levels regarding specific situations on a 4-point scale, categorizing them as "not anxious," "fairly anxious," or "severely anxious." Using the CSIS, participants indicated their coping strategies, which were scored on a 3-point scale. The subgroup with the highest scores was designated as the primary coping strategy. Statistical analyses, including Chi-square, Fisher Exact Test, Independent t-test, and One-way ANOVA, were conducted using SPSS 22 at a significance level of 0.05.

Results: Response rate was 92%. The mean clinical anxiety score was 2.09±0.33. The majority was fairly anxious. Levels of clinical anxiety showed a significant relation with age ($P<0.001$), and academic year ($P=0.002$). Mean score of clinical anxiety was significantly differed due to age ($P<0.001$), and academic year ($P<0.001$). No significant relationship was found between clinical anxiety and gender; neither qualitatively nor quantitatively. Seeking Social Support was the most prevalent coping. Coping had no relation with age, gender, academic year and level of clinical anxiety.

Conclusion: Younger students and those new to clinical training experience higher anxiety, underscoring targeted interventions. Dental schools should implement mental health support to enhance the student well-being preventing psychological challenges.

Keywords: Clinical Anxiety; Coping; Dental Students

Background

There is a high level of stress and anxiety perceived by dental undergraduates during their educational course (1). Theoretical and clinical acquisitions and examinations are stress and anxiety-provoking situations for the dental trainers as transition stage to being professional practitioners in near future (2). However, accepting responsibility for using patient management approaches as well as executing a broad variety of irreversible treatments on dental patients is widely recognized as the primary stressors in establishing scenarios that result in clinical anxiety (2, 3). Clinical anxiety is an emotional reaction in clinical performance stimulated by the transition from pre-clinic to clinic in the dental course. This special anxiety is felt before providing health care which is a complex and multisystem response to clinical stressful events that may affect the student's well-being and academic achievement (2-4).

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Anxiety may be compared to a double-edged knife. Undoubtedly, decreased anxiety promotes academic success and learning. It is worth noting that reduced levels of anxiety cause the student to be more focused, aware, and ready to do specified activities. However, high stress can lead to learning difficulties, poor performance, poor health service, and ultimately learner's illness. Subsequently, the cascade of bad consequences accelerates, and insults the student in personal, interpersonal, and professional relationships (2, 5).

Several numbers of studies were conducted on dental students' population to assess their level of stress and anxiety in academic and personal performance. The great majority of studies have shown that dentistry students had higher levels of stress and anxiety throughout their academic careers than their peers (6-9). Leading researchers in the field of stress have long been looking for a set of "strategies" that people turn to it to deal with their life's problems. There were always efforts to find a tool that is applicable, sensitive enough to cover human diversity, and exactly reflects general coping mechanisms (10). One developed relevant questionnaires, derived from Amirkhan studies (11), which introduced an assessment instrument divided into three aspects of "Problem-Solving" (instrumental active problem-directed approach against stressors), "Seeking Social Support" (turning to others originating from basic needs and characteristics of human beings for comfort, advice, help or simple human contact), and "Avoidance Behavior" (either physical or psychological withdraw such as distraction). Preliminary questionnaires contained too many questions which became shorter over time. Now the summarized, self-reported questionnaire is widely used in research about different populations and contexts with a wide range of generalizability (10, 11).

Dental students use a variety of coping mechanisms when faced with anxiety-inducing circumstances. In this sense, a person's choice of type is greatly influenced by their educational environment. As with any vicious cycle, the person who is under stress may resort to emotion-based (passive) coping rather than problem-based (active) coping, and they may get locked in harmful and inappropriate coping and dealing techniques (4, 12). Up to the authors' knowledge, scarce studies on clinical anxiety and coping strategies in Iranian dental students was found. Clinical anxiety is considered a potential opposing force against the quality of dental training and skill acquisition. The necessity for study in this field is evident from this fact alone. A supportive and stress-relieving clinical education environment may be established by recognizing the perceived causes of stress and being aware of the coping strategies used. So, this study aimed to assess clinical anxiety and associated copying mechanisms in dental undergraduate students of Zahedan University of Medical Sciences.

Objectives

This study aimed to evaluate clinical anxiety and coping mechanisms in students.

Methods

Type and Stages of the Study: In May 2022, a descriptive analytical cross-sectional research was carried out in the southeast Iranian university of medical sciences, Zahedan. The purpose of the research was to evaluate coping strategies and clinical anxiety in undergraduate dentistry students undergoing clinical training. The dental course in Iran is a six-year program, with the first two years focused on basic sciences, one preclinical year, and three years of clinical training alongside didactic courses. Clinical responsibilities, and procedure complexity increase progressively during the fourth to sixth years.

Sample and Population: The study population included 218 undergraduate dental students in their fourth to sixth years at Zahedan University of Medical Sciences. Inclusion criteria were: enrollment in the clinical training years (fourth to sixth), voluntary participation, and no known mental, psychological, or anxiety disorders. Census sampling was used to invite all eligible students. A total of 200 students completed the survey (response rate: 92%).

Data Collection Tools: A three-part self-reported questionnaire was employed to gather data. Part I focused on demographic data to ascertain variables such as age (categorized as <25 or ≥25 years based on), gender, and academic year (fourth-year, fifth-year, and sixth-year).Since the normality of data regarding age of participants was not assured, the cut –off point of 25 was determined based on quartile of 20 and 80. Part II and III dealt with Modified Moss and McManus Scale (MMMS) and Coping Strategy Indicator Scale (CSIS) to study various anxiety-provoking situations and used different coping strategies respectively.

Modified Moss and McManus Scale consists of 38 questions representing different clinical encounters (20 original questions and 18 later-added questions reflecting dental situation) (2, 3, 5)However, for the research design of our study the questionnaire was revised, so that it can be applied to the clinical aspects of training in Zahedan Dental School. Thus, 2 items were

omitted in terms of lack of relevance to dental situation. A native Persian speaker translated the modified original questionnaire. The preliminary version of the questionnaire was subsequently translated back into English to guarantee the veracity of the translation. In addition, to verify face and content validity, a team of experts was requested to assess the preliminary questionnaire. The questionnaire improved after obtaining suitable comments and suggestions. Afterthought: content validity ratio and index have been validated. A content validity ratio of more than 0.62 and a content validity index of greater than 0.79 were used to approve the items. Consequently, three articles were eliminated. The questionnaire was then piloted to ten dental students who were not participants in order to further regulate the translation and ensure that it could be completed in a fair amount of time. After going through this process, the questionnaire considered suitable for distribution. Moreover, to ensure reliability, the questionnaire redistributed among 10% of participating students with a time interval of one month. Alpha-Cronbach coefficient of 77% for Persian version of MMMS was driven. Hence, the final version of questionnaire consisting of 33 items that is applicable to the Iranian dental education background was used to assess clinical anxiety provoking situations. Hence, the questions addressed the possible sources of clinical anxiety as perceived by the student during the past one month, while attending professional school. For statistical analysis, the responses to each item were based on a 4- point Likert-type scale as follows: 1 (not anxious), 2 (slightly anxious), 3 (fairly anxious), 4 (very anxious). Based on this rating, the lowest and highest obtainable value could be 33 and 132 respectively, and the higher value indicates the higher perceived clinical anxiety. The obtained score divided by 33 was recorded as the average score of anxiety of each person and thus individuals were grouped into three categories of “not anxious”, “fairly anxious”, and “severely anxious” with an average in the range of “equal to or greater than 1 to less than 2”, "equal to or greater than 2 to less than or equal 3” and “greater than 3 to less than or equal 4”. In addition, the most to least common stressful situations were reported in a given continuous mean range of 1 to 4 assigned to each item based on the responses of all students.

The Coping Strategies Indicator Scale is divided into three major subgroups: issue resolution, seeking social support, and avoidance behavior (11). The content validity ratio and content validity index were treated as previously. We also validated the dependability of the Alpha-Cronbach coefficient of 81% for the Persian version of CSIS using a similar technique. As a result, the number of questions stayed consistent with the original version. In total, CSIS consisted of 33 items equally distributed in three subgroups (11 per each). The responses including a 3-point scale of “a lot”, “a little” and “not at all” were scored as 3, 2 and 1 respectively for statistical analysis. The score assigned to each subgroup; ranging from 11 to 33; were calculated by the sum of scores allocated to individual items. The high-scored subgroup was identified as the primary copping approach. As a consequence of completing questions, participants were able to identify the kind of coping technique used in response to a recent major and distressing incident that happened during the last six months. Eleven questionnaires that were incompletely filled were not analyzed. Furthermore, 7 questionnaires containing more than one subgroup with the same maximum score were excluded from the study. The final questionnaire was scored as demonstrated in table 1.

Data Analysis: SPSS version 22 (SPSS Inc., Chicago, Illinois, USA) was employed to analyze the data. Frequencies, percentages, and means (± standard deviations) comprised descriptive statistics. The Kolmogorov-Smirnov test was employed to verify the normality of clinical anxiety scores (P>0.05). The relationship between the frequency of various levels of clinical anxiety and age, gender, and academic year was evaluated using the Chi-square and Fisher Exact Tests. Independent t-test examined age and gender differences in mean anxiety scores. One-way ANOVA compared anxiety scores across academic years. Chi-square tests evaluated associations between coping strategies and demographic variables (age, gender, academic year) and between clinical anxiety levels and coping strategies. The significance level was set at 0.05.

Ethical Considerations: The Ethical Committee of Zahedan University of Medical Sciences granted ethical approval (reference number IR.ZAUMS.REC.1401.318). All participants were guaranteed anonymity and confidentiality, and informed consent was obtained. There were no incentives or obligations to participate, and it was entirely voluntary.

Participants were informed of study’s purpose and provided general instructions via email, with an estimated questionnaire completion time of 15 minutes. Responses were anonymous, with no identifiers collected.

Results

The current study assessed the clinical anxiety and coping mechanisms of Zahedan dental students. Two hundred respondents completed the survey (as mentioned before, data of eighteen subjects were not entered in analyses). The mean age of participants was 23.81±1.9 years. The youngest participant was 21 and the eldest was 32 years old. The data distribution of participants according to age, gender, and academic year is presented in table 2.

In this study, 37% (n=74) of dental students were not anxious, 62% (n=124) were fairly anxious, and 1% (n=2) were severely anxious. Moreover, the data regarding the frequency of clinical anxiety in participants based on age, gender, and academic year has been shown in table 3. Considering low frequency in some cells of the table, data of fairly anxious and severely anxious columns were merged as anxious group.

As well, the anxiety of participants was quantitatively reported. The mean of total clinical anxiety score among the dental students was 2.09±0.33. The lowest clinical anxiety score was 1.12 and the highest was 3.48. Respectively, "Extracting the wrong tooth", "Helping in a faint episode", "getting infected by patients", "accidental pulp exposure" were the most stressful items according to MMMS. On the contrary, "discussing with patients", "Interacting with nursing staff", "Taking the patient's history", "Examining patient" and "Telling patients that I do know your diagnosis"" were the least stress provoking items (Table 4).

The relationship between age and the total clinical anxiety score was statistically significant ($P \leq 0.001$), as indicated by the independent t-test. Nevertheless, the independent t-test did not reveal a statistically significant relationship between gender and the total clinical anxiety score ($P = 0.945$). The relationship between the academic year and the total clinical anxiety score was statistically significant ($P<0.001$), as indicated by the one-way ANOVA (Table 5). Sixth-year dental students had a considerably lower mean total clinical anxiety score than fourth- and fifth-year dental students ($P < 0.001$ and $P = 0.001$, respectively). There was no significant difference in the overall clinical anxiety level between fourth- and fifth-year dentistry students ($P = 0.196$). Qualitatively, 26% (n=52) of dental students had the coping strategy of "Problem-Solving", 66% (n=132) had "Seeking Social Support", and 8% (n=16) had the "Avoidance Behavior" coping strategy in the present study. Based on table 6, chi-square analysis showed that coping strategy had no significant relation with age, gender, and academic year (P=0.878, P=0.203, and P=0.969, respectively). The relationship among different levels of clinical anxiety and coping strategy was assessed. Regarding clinical anxiety, since more than 20% of the cells of table were less than 5, the data of two levels of fairly anxious and severely anxious were merged.

Hence, results of the chi-square showed no significant relationship between clinical anxiety and coping strategy (P=0.540).

Discussion

Dental students showed a moderate score of clinical anxiety. The majority experienced a fair level of anxiety, while a smaller proportion reported no anxiety, and a very small fraction showed severe anxiety. In previous studies, a high prevalence of anxiety was observed among dental students (13, 14). According to Basudan et al., anxiety affected almost half of the dentistry students in their research (15). More than 70% of dentistry students suffer moderate to severe levels of stress throughout their education, according to a research by Stormon et al. (13) According to a number of recent studies, between 40 and 50 percent of dentistry students report high levels of stress, which is indicative of the mental health toll that students bear as they adjust to interrupted coursework and heightened health issues (14, 16). The high levels of depression, stress and anxiety may well be ascribed to the pressure of dental course by their workload, clinical requirements, examinations and grades. This raised cautions about the requirement for greater mental health support inside dental schools.

The mean of total clinical anxiety score was higher in females than in males. Recent studies consistently showed that stress levels are higher among female dental students compared to their male counterparts (17, 18). Furthermore, gender roles and societal expectations may exacerbate stress among female dental students. Females often experience more societal pressure to balance academic achievement with traditional gender roles, such as caregiving and maintaining social relationships. This additional weight may induce emotions of shame and stress, especially when academic expectations escalate throughout clinical training (19). This is especially common in competitive domains such as dentistry, where self-assurance is essential for clinical efficacy and patient management. Nonetheless, our investigation did not find any statistically significant gender differences. One of the reasons for the lack of significance difference in stress level of males and females can be the older age of girls, which has led to the

masking of the effect of gender and the lack of significant difference.

Clinical anxiety showed a significant difference based on dichotomized age groups. About 65% of the < 25 years old group were fairly anxious, while this proportion decreased to nearly 50 % in the ≥ 25 years old group. One significant source of stress for younger dental students is the uncertainty surrounding their professional identity. Early in their education, many students are still grappling with whether they have chosen the right career path or whether they will succeed in the demanding field of dentistry (19).

As students age, they generally acquire greater emotional regulation skills, which help them manage stress more effectively.

In our research, fourth- and fifth-year dental students reported being quite worried, whereas sixth-year dental students reported feeling not anxious. Accordingly, Basudan et al. found that anxiety reduced as participants' ages and academic years rose (15). Similarly, Morse and Dravo found that third-year students had the highest degree of anxiety, followed by fourth- and fifth-year students (20). The findings of the research conducted by Grandy et al. and Sanders and Lushington corroborate the outcomes of the present investigation. In the aforementioned studies, dental students began their clinical courses in the third year of their education (21, 22). Consequently, third-year dentistry students had the greatest degree of anxiety relative to their peers. In the present research, dental students at Zahedan University of Medical Sciences began clinical courses in their fourth year; hence, fourth-year dental students exhibited elevated anxiety scores. In contrast to the aforementioned studies and the present research, Jowkar et al. discovered that anxiety levels were highest among fifth-year dentistry students, followed by fourth-year and sixth-year students. The research comprised dentistry students from Shiraz University of Medical Sciences. Jowkar et al. indicate that fifth-year dental students are provided a greater number of clinical courses than their peers, which accounts for their elevated levels of anxiety (23). Divergent outcomes may be attributable to disparate curricula. The experience of stress is prevalent among dental students, with both age and academic year playing significant roles. The tension levels of younger pupils and those in their early academic years are frequently higher than those of their older and more senior peers (24). In the present investigation, there was no statistically significant correlation between clinical anxiety and coping strategy. Additionally, there was no correlation between the prevalence of the coping mechanism and age, gender, or academic year. The primary coping strategy of the students was "seeking social support," while "avoidance" was the least coping mechanism. The most prevalent coping strategy identified in the study conducted by Ersan et al. was "Planning," while the least prevalent coping strategy was "Drug." (25). According to Darwita et al., the most prevalent coping mechanism among dental students was the pursuit of emotional support (26). The current research is consistent with the findings of the aforementioned studies. For the most part, dental students do not engage in detrimental coping mechanisms and rarely pursue narcotics or violence. Previous research has demonstrated that the perceived stress of an individual is influenced by the varied consequences of various coping strategies. For example, Carver et al. asserted that the efficacy and utility of behavioral and/or mental disengagement, as well as the focus on and purging of emotions, may be restricted (27). Conversely, problem-focused coping strategies, including active coping, scheduling, suppressing competing activities, and seeking instrumental social support, alongside emotion-focused strategies such as seeking emotional social support, positive reinterpretation, acceptance, and denial, were found to be comparatively more effective. Dwyer and Cummings asserted that, according to this hypothesis, university students' use of avoidance-focused coping techniques was strongly correlated with stress (28). The increasing use of professional mental health services, and the role of spirituality also highlight the diversity of coping strategies among dental students. By promoting healthy coping mechanisms, and providing adequate support, dental schools can help mitigate the stress and anxiety that students face throughout their education (29). Furthermore, the clinical learning experience for students improves, allowing them to perform with increased assurance (30).

The high response rate and the simple and concise test tool are the strengths of this study. Although the basis of questionnaire was adapted from previous studies in this field, its validity and reliability were assured following some changes in the questionnaire. Our study decreased the bias by utilizing close ended self-reporting questions. The interviewer had no intervention, therefore no misunderstanding in communication was caused between the researcher and participants.

Nonetheless, the authors assert that it has some limits. The present research did not assess changes in psychological state over time due to its cross-sectional

methodology. Furthermore, self-reported evaluation instruments may induce response bias that cannot be disregarded. Additionally, our literature review was restricted to studies published in English, thus excluding comparisons with important results documented in other languages.

Conclusion

It can be concluded that most dental students were fairly anxious in the current study. This study showed the notable presence of clinical anxiety among dental undergraduate students, particularly those in earlier clinical training years, requiring appropriate interventions to address this issue. Dental schools should implement practical measures to support student well-being, such as integrating stress management workshops into the curriculum, establishing peer mentorship programs to guide students transitioning into clinical practice, and providing accessible mental health resources, including counseling services. Moreover, cultivating an educational atmosphere that encourages adaptive coping mechanisms, including problem-solving and soliciting social support, can bolster students' resilience, enhance academic achievement, and guarantee superior patient care, thereby diminishing the likelihood of enduring psychological distress and professional burnout. To improve the accuracy of outcomes, it is advisable to use a longitudinal design in future studies that include a greater number of schools on a national or worldwide level. Future research on this area is crucial. Moreover, both students and staff should be informed about the signs and symptoms of anxiety and depression, as well as their impact on the physical and psychological well-being of students, to facilitate early identification and timely intervention. To enhance student health, mitigate dropout rates, and assure adequate patient care, dentistry schools should include measures for stress avoidance and management. The continuation of these issues may lead to further physical and psychological challenges that linger post-graduation, resulting in unhealthy dentists or premature retirement, so diminishing both the number and quality of the workforce.

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References

1. Mousavi-Nasab SMH, Shamsi Nezhad M. Comparison of Academic Motivation, Academic Self-efficacy, and Optimism Among First- and Fifth-year Professional Doctorate Students of Kerman University of Medical Sciences, Kerman, Iran. Strides Dev Med Educ. 2020; 17(1): 1-6. doi: 10.22062/sdme.2020.91481.
2. Malvania Damani E, Ekta M, Sheth S, Sharma A, Trishla G. Assessment of Clinical Anxiety Among Third and Final Year Undergraduate Students of Dental Colleges of Ahmedabad City: A Cross-Sectional Study. Int J Recent Sci Res. 2020; 11 (8): 39454-8.
3. Obarisiagbon A, Azodo CC, Omoaregba JO, James BO. Clinical anxiety among final year dental students: The trainers and students perspectives. Sahel Med J. 2013;16(2):64-70. doi:10.4103/1118-8561.115263.
4. Malghani PG, Abbasi LS, Majeed S, Saleem T. Level of anxiety in clinical settings and coping mechanisms used by dental undergraduate students to overcome it. J Dent Educ. 2021 Nov;85(11):1749-1755. doi: 10.1002/jdd.12751. [PMID: 34319606]
5. Obarisiagbon A, Azodo C, Omoaregba J, James B. Do Stages of Dentistry Training Affect Anxiety Provoking Situations? Ann Med Health Sci Res. 2014 Nov;4(6):869-74. doi: 10.4103/2141-9248.144885. [PMID: 25506478] [PMCID: PMC4250983]
6. Shadman N, Raoof M, Amanpour S, Mahdian M, Haghani J, Torabi Parizi M. Stress, Anxiety, and Depression and Their Related Factors Among Dental Students: A Cross-Sectional Study from Southeast of Iran. Strides Dev Med Educ. 2019; 16(1): e74295. doi: 10.5812/sdme.74295.
7. Malekzadeh M, Ezoji M, Maleki D. Knowledge and Practice of Dental Students in Guilan University about Halitosis: A Randomized Questionnaire-Based Cross-Sectional Study. Journal of Dentomaxillofacial Radiology, Pathology and Surgery. 2018;7(4):137-44. doi: 10.32598/3dj.7.4.137.
8. Farshad F, Kheirkhah M, Virtanen J, Hessari H. Role of the Educational Atmosphere on Self-Efficacy Among Dental Students. Strides Dev Med Educ. 2023; 20(1): 137-44. doi: 10.22062/sdme.2023.198514.1206.
9. Gerreth K, Chlapowska J, Lewicka-Panczak K, Sniatala R, Ekkert M, Borysewicz-Lewicka M. Self-Evaluation of Anxiety in Dental Students. Biomed Res Int. 2019 Dec 28:2019:6436750. doi: 10.1155/2019/6436750. [PMID: 31950047] [PMCID: PMC6949669]
10. Desmond D, Shevlin M, Maclachlan M. Dimensional analysis of the coping strategy indicator in a sample of elderly veterans with acquired limb amputations. Pers Individ Differ. 2006;40:249-59. doi:10.1016/j.paid.2005.04.015.
11. Amirkhan J. A Factor Analytically Derived Measure of Coping: The Coping Strategy Indicator. Journal of Personality and Social Psychology. 1990;59(5):1066-74. doi:10.1037/0022-3514.59.5.1066.

12. Schmitter M, Liedl M, Beck J, Rammelsberg P. Chronic stress in medical and dental education. Med Teach. 2008 Feb;30(1):97-9. doi: 10.1080/01421590701769571. [PMID: 18278661]
13. Stormon N, Ford PJ, Kisely S, Bartle E, Eley DS. Depression, anxiety and stress in a cohort of Australian dentistry students. Eur J Dent Educ. 2019 Nov;23(4):507-514. doi: 10.1111/eje.12459. [PMID: 31373762]
14. Braz-José C, Morais Caldas I, de Azevedo Á, Pereira ML. Stress, anxiety and depression in dental students: Impact of severe acute respiratory syndrome-coronavirus 2 pandemic. Eur J Dent Educ. 2023 Aug;27(3):700-706. doi: 10.1111/eje.12858. [PMID: 36176054] [PMCID: PMC9538255]
15. Basudan S, Binanzan N, Alhassan A. Depression, anxiety and stress in dental students. Int J Med Educ. 2017 May 24:8: 179-186. doi: 10.5116/ijme.5910.b961. [PMID: 28553831] [PMCID: PMC5457790]
16. Hosen I, Al-Mamun F, Mamun MA. Prevalence and risk factors of the symptoms of depression, anxiety, and stress during the COVID-19 pandemic in Bangladesh: a systematic review and meta-analysis. Glob Ment Health (Camb). 2021 Dec 29:8:e47. doi: 10.1017/gmh.2021.49. [PMID: 35145709] [PMCID: PMC8794743]
17. Rabiei M, Safarpour M. Assessment of Dental Environment Stress and Related Factors in Dental Students. Res Med Edu. 2017; 9 (1): 57-46. doi: 10.18869/acadpub.rme.9.1.57.
18. Dalband M, Farhadi Nasab A. Evaluation of Stress-Inducing Factors of Educational Environment in Hamadan Dentistry School's Students. Avicenna J Clin Med. 2007; 13 (4): 48-52. [In Persian]
19. Elani HW, Allison PJ, Kumar RA, Mancini L, Lambrou A, Bedos C. A systematic review of stress in dental students. J Dent Educ. 2014;78(2):226-42. doi:10.1002/j.0022-0337.2014.78.2.tb05673.x. [PMID: 24489030]
20. Morse Z, Dravo U. Stress levels of dental students at the Fiji School of Medicine. Eur J Dent Educ. 2007 May;11(2):99-103. doi: 10.1111/j.1600-0579.2007.00435.x. [PMID: 17445006]
21. Grandy TG, Westerman GH, Combs CE, Turner CH. Perceptions of stress among third-year dental students. J Dent Educ. 1989 Dec; 53(12):718-21. doi:10.1002/j.0022-0337.1989.53.12.tb02378.x. [PMID: 2592659]
22. Sanders AE, Lushington K. Sources of stress for Australian dental students. J Dent Educ. 1999;63(9):688-97. doi:10.1002/j.0022-0337.1999.63.9.tb03304.x. [PMID: 10518206]
23. Jowkar Z, Masoumi M, Mahmoodian H. Psychological Stress and Stressors Among Clinical Dental Students at Shiraz School of Dentistry, Iran. Adv Med Educ Pract. 2020 Feb 12:11: 113-120. doi: 10.2147/AMEP.S236758. [PMID: 32104133] [PMCID: PMC7024806]
24. Horri A, Amanpour S, Jalali F, Masoumi M, Fardisi S. The Use of Different Study Skills by Undergraduate and Postgraduate Students of Kerman Dental School. Strides Dev Med Educ. 2020;17(1): e99478. doi:10.22062/sdme.2020.91012.
25. Ersan N, Dölekoğlu S, Fişekçioğlu E, İlgüy M, Oktay İ. Perceived sources and levels of stress, general self-efficacy and coping strategies in preclinical dental students. Psychol Health Med. 2018 Jun;23(5):567-77. doi: 10.1080/13548506.2017.1384844. [PMID: 28984170]
26. Darwita RR, Savitri PA, Khairinisa S, Ramadhani A, Adiatman M, Maharani DA, et al. Comparative analysis of stress level and coping strategies due to COVID-19 pandemics among dental students in Indonesia and Vietnam. Heliyon. 2024 Jul 10;10(14):e34452. doi: 10.1016/j.heliyon.2024.e34452. [PMID: 39114078] [PMCID: PMC11305215]
27. Carver C, Scheier M, Weintraub J. Assessing Coping Strategies: A Theoretically Based Approach. J Pers Soc Psychol. 1989 Feb;56(2):267-83. doi: 10.1037//0022-3514.56.2.267. [PMID: 2926629]
28. Dwyer A, Cummings A. Stress, self-efficacy, social support, and coping strategies in university students. Canadian Journal of Counselling and Psychotherapy. 2001;35(3):208-20.
29. Hatami S, Shekarchizadeh H. Relationship between spiritual health, resilience, and happiness among a group of dental students: a cross-sectional study with structural equation modeling method. BMC Med Educ. 2022 Mar 16;22(1):184. doi: 10.1186/s12909-022-03243-8. [PMID: 35296319] [PMCID: PMC8928650]
30. Salari Z, Horri A, Tahmasbi A, Shojayeepour R, Jahanimoghadam F. Evaluation of the Clinical Learning Environment (CLE) Using the Postgraduate Hospital Educational Environment Measure (PHEEM) in Viewpoint of Dental Residents: A Multicenter Study in Iran. Strides Dev Med Educ. 2023; 20(1): 66-74. doi: 10.22062/sdme.2023.198063.1137.

Table 1. Score and Score Range of Each Part of Questionnaire

	Questions		Response and Score	
I: Demographics	Age		<25 years old, ≥25 years old	
	Gender		Female, Male	
	Study Year		4th- year, 5th- year, 6th- year	
II: MMMS	1	Getting diagnosis wrong	Responses to each item were based on a 4- point scale as follows: Not anxious (1) Slightly anxious (2) fairly anxious (3) Very anxious (4) Total Range: 33-132	Total score divided by 33 was recorded as the average score of anxiety of each person. Then, subjects grouped into: not anxious: equal to or greater than 1 to less than 2 fairly anxious: equal to or greater than 2 to less than or equal 3
	2	Presenting in the clinic		
	3	Inadvertently hurting patient		
	4	Telling consultants that "I don't know anything"		
	5	Getting infected by patients		
	6	Dealing with psychiatric patients		
	7	Making diagnosis		
	8	Being asked difficult questions by patients		
	9	Treating children		
	10	Telling patients that "I do know your diagnosis"		
	11	Giving local anesthesia		
	12	Examining patient		
	13	Telling patients that "I don't know anything"		

	14	Taking the patient's history		severely anxious: greater than 3 to less than or equal 4”
	15	Interacting with nursing staff		
	16	Discussing with patients		
	17	Grasping extraction forceps		
	18	Arresting post-operative bleeding		
	19	Helping in a faint episode		
	20	Fracturing a tooth during extraction		
	21	Using high-speed hand piece		
	22	Accidental pulp exposure		
	23	Extracting wrong tooth		
	24	Not taking radiographs properly		
	25	Not developing radiograph properly		
	26	Not being able to interpret radiographic findings		
	27	Discovering calculus by supervisor after scaling		
	28	Not able to defend diagnosis		
	29	Not meeting requirement for examination		
	30	Inability to pass practical courses		
	31	Dealing with children		
	32	Dealing with elderly patients		
	33	Iatrogenic gingival trauma		
III: CSIS	1	Explained your feelings to a friend (SSS).	a lot (3) a little (2) not at all (1) The score assigned to each subgroup ranged from 11 to 33. The high-scored subgroup was labeled as the main applied copping strategy.	
	2	Checked everything again so your problem could be solved (PS).		
	3	Thought of different ideas before making decision what to do (PS).		
	4	Tried to distract yourself from the problem (A).		
	5	Accepted sympathy and understanding from someone (SSS).		
	6	Did all you could to keep others from noticing the severity of the situation (A).		
	7	Talked to others about the problem because doing that makes you feel better (SSS).		
	8	Sat some goals for yourself to deal with the situation (PS).		
	9	Weighed up your options carefully (PS).		
	10	Daydreamed about better times (A).		
	11	Tried different ways to solve the problem until you found one that worked (PS).		
	12	Talked about your fears and worries with a relative or friend (SSS).		
	13	Spent more time alone than usual (A).		
	14	Told people about the situation because it helped you come up with solutions (SSS).		
	15	Thought about what needs to be done to make things right (PS).		
III: CSIS	16	Turned your full attention to solving the problem (PS).		
	17	Designed a plan in your mind (PS)		
	18	Watched TV more than usual (A)		
	19	Went to a friend or professional to help you feel better (SSS).		
	20	Stood firm and fought for what you wanted in the situation (PS)		
	21	Avoided being with people in general (A).		

	22	Buried yourself in a hobby or sports activity to avoid the problem (A).	
	23	Went to a friend to help you feel better about the problem (SSS).	
	24	Went to a friend for advice about how to change the situation (SSS).	
	25	Accepted sympathy from friends who had the same problem (SSS).	
	26	Slept more than usual (A)	
	27	Daydreamed about how things could have been different (A).	
	28	Identified with characters in movies or novels (A)	
	29	Tried to solve the problem (PS).	
	30	Wished that people would just leave you alone (A).	
	31	Accepted help from a friend or relative (SSS)	
	32	Sought reassurance from those who know you best (SSS)	
	33	Tried to carefully plan a course of action rather than acting on impulse (PS).	

PS: Problem Solving, SSS: Seeking Social Support, A: Avoidance

Table 2. The data distribution of participants

Demographic Parameter		Percent (Number)
Age	<25 years old	74. 00% (148)
	≥25 years old	26.00% (52)
Gender	Female	51.00% (102)
	Male	49.00% (98)
Academic year	Fourth-year	39.50% (79)
	Fifth-year	34.50% (69)
	Sixth-year	26.00% (52)

Table 3. The frequency of clinical anxiety in participants according to age, gender, and academic year

Demographic Parameter		Clinical Anxiety [Percent (Number)]		P Value
		Not Anxious	Anxious	
Age	<25 years old	33.80% (50)	66.20% (98)	< 0.001*
	≥25 years old	46.20% (24)	53.80% (28)	
Gender	Female	37.30% (38)	62.70% (64)	0.372*
	Male	36.70% (36)	63.30% (62)	
Academic year	Fourth-year	26.60% (21)	73.40% (58)	0.002**
	Fifth-year	36.20% (25)	63.80% (44)	
	Sixth-year	53.80% (28)	46.20% (24)	

*Fisher Exact Test, **Chi-square test

Table 4. Mean scores of participants in the questions of MMMS

MMMS		Mean (SD)
1	Getting diagnosis wrong	2.45 (0.81)
2	Presenting in the clinic	1.77 (0.77)
3	Inadvertently hurting patient	2.71 (0.86)
4	Telling consultants that "I don't know anything"	1.94 (0.81)
5	Getting infected by patients	3.02 (0.98)
6	Dealing with psychiatric patients	2.13 (0.86)
7	Making diagnosis	1.69 (0.71)
8	Being asked difficult questions by patients	1.76 (0.75)

9	Treating children	1.99 (0.88)
10	Telling patients that "I do know your diagnosis"	1.47 (0.72)
11	Giving local anesthesia	1.61 (0.62)
12	Examining patient	1.37 (0.59)
13	Telling patients that “I don't know anything”	1.96 (0.96)
14	Taking the patient's history	1.30 (0.62)
15	Interacting with nursing staff	1.28 (0.62)
16	Discussing with patients	1.27 (0.57)
17	Grasping extraction forceps	1.70 (0.75)
18	Arresting post-operative bleeding	1.84 (0.79)
19	Helping in a faint episode	3.10 (0.94)
20	Fracturing a tooth during extraction	2.53 (0.89)
21	Using high-speed hand piece	1.91 (0.84)
22	Accidental pulp exposure	2.87 (0.91)
23	Extracting wrong tooth	3.49 (0.82)
24	Not taking radiographs properly	2.09 (0.77)
25	Not developing radiograph properly	1.99 (0.72)
26	Not being able to interpret radiographic findings	2.20 (0.82)
27	Discovering calculus by supervisor after scaling	2.71 (1.02)
28	Not able to defend diagnosis	2.58 (0.92)
29	Not meeting requirement for examination	1.97 (0.81)
30	Inability to pass practical courses	2.65 (0.95)
31	Dealing with children	1.92 (0.86)
32	Dealing with elderly patients	1.69 (0.73)
33	Iatrogenic gingival trauma	2.24 (0.81)

SD: Standard deviation

Table 5. The mean of clinical anxiety in participants according to age, gender and academic year

Demographic Parameter		Clinical Anxiety (Mean (SD))	P Value
Age	<25 years old	2.13 (0.23)	<0.001*
	≥25 years old	2.01 (0.15)	
Gender	Female	2.12 (0.29)	0.945*
	Male	2.06 (0.37)	
Academic year	Fourth-year	2.20 (0.35)	<0.001**
	Fifth-year	2.11 (0.27)	
	Sixth-year	1.90 (0.3)	

*Independent T test, **One Way ANOVA

SD: Standard deviation

Table 6. The frequency of coping strategy in participants according to age, gender, and academic year and clinical anxiety

Demographic Parameter	Group	Coping Strategy (Percent and Number)			P value
		Problem-Solving	Seeking Social Support	Avoidance Behavior	
Age	<25 years old	26.40% (39)	66.20% (98)	7.40% (11)	0.878*
	≥25 years old	25.00% (13)	65.40% (34)	9.60% (5)	
Gender	Female	20.60% (21)	70.60% (72)	8.80% (9)	0.203*
	Male	31.60% (31)	61.20% (60)	7.10% (7)	
Academic year	Fourth-year	26.60% (21)	67.10% (53)	6.30% (5)	0.969*
	Fifth-year	26.10% (18)	65.20% (45)	8.70% (6)	
	Sixth-year	25.00% (13)	65.40% (34)	9.60% (5)	
Clinical Anxiety	Not Anxious	20.30% (15)	67.60% (50)	12.20% (9)	0.540*
	Fairly Anxious	29.80% (37)	65.30% (81)	4.80% (6)	
	Severely Anxious	0.00% (0)	0.05% (1)	0.05% (1)	

*Chi-square test

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Review Article

Unblocking Innovation: A Meta-Synthesis of Blockchain Applications in Medical Education, Research, and Healthcare

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Abstract

Background: In today's digital era, challenges related to privacy, security, and transparency in the management of sensitive medical data continue to impede progress in healthcare innovation. Blockchain technology, with its decentralized and tamper-resistant architecture, presents a promising avenue to address these issues. However, a comprehensive meta-synthesis examining blockchain applications across medical education, research, and healthcare delivery remains lacking.

Objectives: The purpose of this study is to investigate and identify the applications of blockchain technology within the domains of medical education, medical research, and healthcare.

Methods: The current study utilized a meta-synthesis methodology to analyze 49 peer-reviewed articles published between 2008 and 2025. Sources were identified through systematic searches of reputable academic databases and selected based on defined inclusion and exclusion criteria aligned with PRISMA guidelines. Relevant data were extracted, coded, categorized, and synthesized into overarching thematic domains.

Results: Findings revealed that blockchain enhances medical education by improving the issuance and verification of academic credentials, enabling adaptive learning, supporting competency-based assessments, and promoting interactive, learner-centered environments. In the domain of medical research, blockchain contributes to secure data sharing, improved research ethics, enhanced transparency, and more effective inter-institutional collaboration. In healthcare delivery, the technology enables secure and interoperable health record management, pharmaceutical supply chain monitoring, privacy-preserving telemedicine, and intelligent clinical decision-making. Overall, these applications were categorized into six thematic categories for education, eight for research, and nine for healthcare.

Conclusion: Blockchain technology, by offering a secure, transparent, and decentralized infrastructure, holds significant potential to transform medical education, research, and healthcare delivery. The findings of this meta-synthesis provide a conceptual framework for the optimal integration of blockchain within the healthcare system and illuminate pathways for future research aimed at advancing the practical applications of this technology.

Keywords: Blockchain; Medical Education; Medical Research; Health Care; Technology Assessment

Background

Access to accurate and comprehensive medical data is fundamental to the effective delivery of healthcare services. Yet, the digital era presents a paradox: while vast amounts of patient information are now digitally stored in electronic health records (EHRs) and medical devices, this enhanced accessibility concurrently exposes significant vulnerabilities in data privacy and security. Traditional centralized data repositories are prone to cyberattacks, human error, and a lack of

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transparency, thereby raising concerns about trustworthiness and potential misuse of sensitive medical information (1). Furthermore, medical data often remain siloed within individual institutions, impeding timely clinical decision-making and limiting opportunities for cross-institutional research collaboration. To address these challenges, blockchain technology has emerged as a promising decentralized infrastructure that offers tamper-resistant data management. The intrinsic cryptographic techniques and distributed network architecture of blockchain technology provide robust protection against unauthorized access and data manipulation, especially in handling large-scale healthcare datasets (2). Structurally, blockchain can be defined as a sequential ledger comprising interconnected blocks (3). Each block consists of a header and a body with the body containing transactional data while the header including a cryptographic hash of the preceding block, thereby ensuring the immutability and chronological integrity of the chain (4). Since the latter half of 2017, blockchain has garnered increasing attention from key stakeholders in the healthcare sector (5), with forecasts predicting substantial growth in applications such as EHR management, insurance claims processing, biomedical research, pharmaceutical supply chain oversight, and medical education (6-7). Stagnaro (8) highlights five critical applications of blockchain capable of mitigating persistent healthcare challenges, incuding creation of longitudinal health records, automated insurance claims, interoperability among heterogeneous systems, patient-controlled data access, and secure pharmaceutical supply chain management. Despite its transformative potential in enhancing data integrity, transparency, and decentralized trust, blockchain adoption faces multifaceted challenges including ethical considerations (9), unintended reinforcement of power asymmetries via smart contracts (10), lack of standardized protocols (11), privacy concerns (12), legal ambiguities regarding digital asset ownership (13), economic barriers related to infrastructure and energy consumption (14), and limited user acceptance due to technological literacy gaps (15). These complexities underscore the necessity for a multidisciplinary approach integrating ethical, legal, social, and technical perspectives to responsibly advance blockchain solutions in healthcare.

In contemporary healthcare, access to accurate, comprehensive, and timely medical data is essential for effective service delivery. The digital transformation has facilitated widespread adoption of electronic health records (EHRs) and medical devices, significantly increasing data availability. However, this advancement also introduces critical challenges related to data security and patient privacy. Centralized data systems remain vulnerable to cyberattacks, human errors, and transparency deficits, undermining trust in healthcare data management. Additionally, the fragmentation of medical information across multiple institutions restricts timely care delivery and impedes cross-institutional research collaboration. Despite the growing recognition of blockchain technology as a promising solution to these issues, there remains a significant research gap regarding its comprehensive applications in medical education, research, and healthcare services. Much of the existing literature addresses isolated aspects without offering an integrative, content-driven synthesis. Emerging evidence suggests blockchain's potential to enhance pharmaceutical supply chains, automate insurance claims, increase transparency in biomedical research, and improve patient access to records; however, these applications have yet to be examined holistically. To address this gap, the current study employed a meta-synthesis methodology to systematically analyze qualitative research on blockchain applications in medical fields. This interdisciplinary approach can facilitate the identification of conceptual gaps, thematic overlaps, and emerging trends, providing a unified framework to understand blockchain's multifaceted role, challenges, and future prospects in healthcare, education, and research.

Objectives

The purpose of this study is to investigate and identify the applications of blockchain technology within the domains of medical education, medical research, and healthcare.

Methods

The present study adopted a qualitative research design consistent with its objective, subject matter, and methodological approach. Specifically, it employed the meta-synthesis strategy, defined as a systematic integration and interpretation of findings from multiple studies within a particular domain, aimed at generating a deeper understanding of the phenomenon under investigation. This process involves four main stages: formulating research questions, applying a search

strategy, extracting key concepts, and synthesizing those concepts (16).

Designing Research Questions

As the initial phase of the meta-synthesis mapping process, we formulated three core research questions aligned with our aim to explore and clarify the current advancements and trends in the utilization of blockchain technology within the domains of education, scientific research, and healthcare. The research questions addressed in this study were as follows:

1) What are the applications of blockchain in the field of medical education?
2) What are the applications of blockchain in the field of medical research?
3) What are the applications of blockchain in the field of healthcare?

Systematic Review Search Strategy

In the second phase involving the systematic mapping process, primary studies were selected by searching scientific databases using a search string and specific keywords.

Data Sources and Search Strategies

Studies published between 2008 to 2025 were included in the research. November 2008 was set as the starting point for the publications included in this systematic investigation, as it marks the introduction of blockchain technology by Satoshi Nakamoto. To gather a wide range of scholarly work, searches were carried out across multiple academic databases, including ACM Digital Library, Emerald, Google Scholar, IEEE, Science Direct, Springer, PubMed, Taylor & Francis Online, and Wiley Online Library. We used a carefully designed search strategy based on the keyword set outlined in Table 1 to identify relevant publications. Since search terms serve as the primary gateway for retrieving meaningful literature, their accurate selection was essential to ensure the relevance and quality of the included sources (17). The initial search yielded 274 records, among which 17 were identified as duplicates and removed. Therefore, the remaining 257 studies were reviewed according to the inclusion and exclusion criteria, resulting in the identification of a total of 49 studies fulfilling the eligibility requirements. The entire search and screening process adhered to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (18), as visually summarized in Figure 1.

Table 1 outlines a comprehensive keyword search strategy combining both broad and specific Boolean queries to capture the intersection of blockchain technology and its applications in medical education, healthcare innovation, and medical research.

Inclusion and Exclusion Criteria

The articles that met the inclusion and exclusion criteria (Table 2) were subjected to detailed analysis for the Meta-Synthesis research.

Quality Assessment

A quality evaluation was performed on the eligible studies (N = 49), using seven criteria derived from a structured assessment framework. As emphasized by Al-Emran et al. (19), evaluating the quality of studies is as critical as applying inclusion and exclusion standards. The assessment tool, illustrated in Table 3, was adapted from the recommendations of Kitchenham and Charters (20), with modifications tailored to the current study's context.

It is important to note that the checklist was not intended to criticize the work of any individual researcher.

A three-tier scoring system was used, assigning 1 point for "Yes," 0.5 for "Partially," and 0 for "No" responses. Each article could achieve a score ranging from 0 to 7 with a higher score reflecting a stronger capacity to effectively address the research questions. The quality assessment results for each article are shown in Table 3, confirming that all 49 studies fulfilled the quality standards and were deemed suitable for further in-depth analysis. Three independent researchers conducted the quality assessment separately, and any discrepancies were resolved through discussion and consensus.

Data Analysis

Data Extraction: The general characteristics of the included studies were extracted to provide a comprehensive understanding of the literature. Key information included author(s), country of origin, research objectives, methodologies, and main findings. Globally, researchers have extensively investigated the potential of blockchain in healthcare and medical education. Distinct regional emphases were observed: the United Kingdom and the United States concentrated on data security and smart contracts; India prioritized electronic health records (EHRs) and drug traceability; Pakistan explored credentialing and artificial intelligence (AI) integration; and China, Taiwan, and Singapore examined strategic technology models. In contrast, Canadian studies focused on interoperability and supply chain management. Additional research from other countries addressed governance, clinical trials, and applications in low-resource settings,

collectively reflecting a global and multidisciplinary effort to advance blockchain adoption in healthcare.

Data Coding and Analysis: References (21–69) are provided in Table 2. An inductive, interpretive content analysis was conducted to analyze the qualitative data (70). Themes were derived directly from the raw text, without reliance on predefined theories. Relevant article sections were transcribed and repeatedly reviewed to ensure contextual understanding. The entire article functioned as the unit of analysis to maintain conceptual integrity. Text was segmented into condensed meaning Units, each assigned a representative code reflecting its core idea. Codes were then grouped into themes based on semantic similarity, conceptual coherence, contextual relevance, and frequency of occurrence. This approach ensured a nuanced, data-driven interpretation of the phenomenon under investigation.

Data Validation: To evaluate the consistency of the results, all identified conceptual elements were subjected to a reliability assessment. The procedure involved a single researcher conducting the categorization process on two separate occasions. By comparing the outcomes from both sessions, the degree of classification consistency was determined. Codes that remained the same across both rounds were marked as "matches," while differing codes were labeled as "non-matches." The frequency of matches and non-matches was then applied to a specific equation to calculate the overall stability of the coding process. In this study, the coding was repeated by the same researcher after a 20-day interval, yielding a total of 417 unique items, of which 201 were consistently categorized across both sessions. The resulting test–retest reliability was calculated at 96%, far exceeding the commonly accepted benchmark of 60%, thereby confirming the robustness and dependability of the coding procedure.

$$\text{Test-Retest Reliability} = 100 \times \left(\frac{201\times 2}{417}\right) = 96\%$$

Ethical Considerations: The authors have avoided plagiarism, faithfully cited original authors, and respected intellectual property throughout the review process. Additionally, the analysis was conducted with transparency and objectivity to maintain scholarly rigor.

Results

The content analysis of the selected studies led to the identification of the main themes related to the applications of blockchain technology in the fields of education, research, and healthcare. These conceptual themes were extracted based on the frequency of their occurrence in the reviewed studies and the relevance of the associated keywords. To illustrate the significance and level of focus on each theme, charts were employed to visually represent frequency distributions and facilitate comparisons across key concepts. The findings are presented in three separate summary tables (i.e., Tables 4-6).

Applications of blockchain in medical education: Table 4 presents the applications of blockchain in medical education, categorized into six main themes based on their underlying key concepts and grouped according to their conceptual similarities and differences. The frequency of each theme is also indicated to reflect its relative emphasis within the reviewed literature.

As summarized in Table 4, the results highlighted blockchain's key role in medical education, particularly in the secure management of academic records and the verification of credentials to enhance trust and transparency. The results were also indicative of the role of blockchain technology in supporting personalized learning through adaptive pathways and data analysis. Based on the reviewed literature, interactive platforms such as the metaverse encourage collaboration and immersive simulations, while continuous data-driven assessments enhance decision-making and professional development. Overall, blockchain optimizes educational processes, significantly enhancing the efficiency and quality of medical education systems.

As illustrated in Figure 2, 'Academic records management', with the highest frequency (n=15), represented the most prominent application of blockchain in education, while 'Learning in the metaverse environment', with the lowest frequency (n=8), received comparatively less attention among the identified themes.

Applications of blockchain in medical research: The applications of blockchain in the field of medical research are summarized in Table 5.

These applications are categorized into eight main themes, derived from their underlying key concepts. The frequency associated with each main theme is also provided to indicate the extent of emphasis within the analyzed literature.

The data analysis revealed blockchain's vital role in medical research by enhancing security, transparency, and efficiency. As indicated across the reviewed studies, the immutable infrastructure of this technology can safeguard data integrity and prevent manipulation, thereby fostering trust among stakeholders. The

findings also demonstrated that blockchain promotes reliable interdisciplinary collaboration, research accountability, and ethical practices through permanent traceability. Additionally, it automates research processes by increasing productivity and supporting study design to data analysis. These features underscore blockchain's emerging importance as a key enabler of scientific innovation.

As displayed in Figure 3, 'Trust, accountability, and research ethics' and 'Automation and research efficiency' (n=14 each) emerged as the most frequently reported applications of blockchain in research. In contrast, 'Research data management' and 'Research governance' (n=8 each) were the least emphasized among the identified themes.

Applications of blockchain in the field of healthcare: Table 6 presents the key applications of blockchain in healthcare. These applications are categorized into nine main themes based on their underlying key concepts, with the corresponding frequency of each theme also being provided to indicate their relative emphasis in the reviewed literature.

The analysis of the literature highlighted blockchain's crucial role in healthcare by enhancing data security, transparency, and integrity.

The key applications identified include patient record management, pharmaceutical supply chain oversight, and data privacy. As indicated in the findings, blockchain also supports telemedicine, personalized care, and inter-institutional data exchange, driving digital transformation. Additionally, it improves efficiency by streamlining insurance and billing processes while reducing errors. Figure 4 illustrates the relative frequency of these key themes in the data.

As shown in Figure 4, 'Health data and records management" (n=63) and 'Pharmaceutical supply chain' (n=62) were found to be the most prominent applications of blockchain in the healthcare sector. In contrast, 'Continuous health monitoring and evaluation' (n=11) was the least discussed application.

Discussion

Artificial intelligence has revolutionized medicine, notably enhancing education and research. Among these advances, blockchain ensures data transparency, security, and immutability, fostering trust in digital transactions. By removing intermediaries, blockchain technology improves efficiency across sectors. This study systematically explores blockchain's applications in medical education, research, and healthcare.

Applications of blockchain medical education: Blockchain technology presents diverse and promising applications in medical education. By facilitating personalized learning pathways, blockchain enables students to tailor their educational journeys to their unique needs, interests, and career objectives. Blockchain technology can significantly enhance collaborative learning by providing a secure and transparent platform that fosters interaction and cooperation among students. Through decentralized data sharing, learners can actively engage in group tasks while maintaining shared responsibility and accountability for both individual and collective outcomes. Moreover, the immutability and transparency of blockchain records promote trust and reflection within the learning process, thereby strengthening the overall effectiveness of active and participatory learning (71). A key application of blockchain is the secure issuance, validation, and sharing of academic credentials. Digital certificates recorded on the blockchain are tamper-proof, mitigating risks of forgery and manipulation (72). Additionally, blockchain can maintain immutable, encrypted academic transcripts that document students' comprehensive educational records, such as grades, certifications, and honors, in a decentralized and transparent manner. This improves record security and simplifies administrative processes like verification and credential transfer (73). Blockchain also offers innovative solutions for learner assessment. In blockchain-enabled educational settings, students' performance data, covering grades, skill development, and group participation, can be securely and transparently stored. This is particularly valuable in collaborative learning, where peer assessments can be immutably recorded, ensuring fairness and reducing bias (74). While these applications highlight blockchain's transformative potential, challenges persist. High energy consumption, increasing confirmation times, and scalability issues pose significant barriers, especially given the large volumes of educational data processed by institutions (75). Addressing these challenges is critical for broader adoption in medical education. These insights align with the findings of the current study and are consistent with prior research on blockchain applications in medical education (21-23, 32, 33, 49, 51, 54).

Applications of blockchain in medical research: Blockchain technology has shown substantial potential in transforming medical research, particularly in clinical trials where data integrity, security, and transparency are paramount. As a decentralized and tamper-resistant infrastructure, blockchain enables secure, traceable, and efficient data sharing and storage, allowing all data interactions within clinical studies to be closely monitored (76). This immutability enhances the credibility of research findings, ensuring that clinical trial data remain accurate, verifiable, and resistant to manipulation (77). Furthermore, blockchain allows for decentralized storage of sensitive personal data with strict access controls, protecting participant privacy. Smart contracts can automate and enforce research protocols, ensuring consistent adherence to data collection and analysis procedures. This automation enhances transparency, regulatory compliance, and operational efficiency across the research pipeline (78). In addition to improving data integrity, blockchain helps address challenges related to data authenticity and validation, thereby increasing trust in scientific outputs and enabling more reliable drug development and policy decisions (79). These capabilities align with the findings of the current study and are supported by prior research (22-24, 26, 28, 32-34, 37-40, 43, 44, 47, 50, 51, 53, 55, 58-63, 67). However, the adoption of blockchain in medical research faces obstacles, particularly for researchers lacking technical expertise. The complexity of system design, implementation, and maintenance may hinder widespread integration (80).

Applications of blockchain in healthcare: Blockchain technology offers transformative potential within the healthcare sector by enabling secure, integrated, and interoperable management of patient data. Through decentralized and immutable data storage, blockchain ensures that medical records are tamper-proof and accessible only to authorized users, supporting the creation of unified health records updated in real time across providers (81). This enhances data sharing, streamlines access to records, and strengthens data privacy. In pharmaceutical supply chains, blockchain improves traceability and auditability through both on-chain and off-chain data management. Research has highlighted its role in fraud detection, EMR optimization, and privacy protection, particularly when integrated with emerging technologies like IoT (82). Blockchain also supports shared infrastructures between insurers and healthcare institutions, facilitating faster claims processing and real-time billing with increased transparency and accuracy (83). Furthermore, it secures healthcare communication systems, promoting trust and system interoperability (84). In personalized medicine, blockchain enables the secure storage of sensitive data, such as genomic and lifestyle information, supporting AI-driven, patient-specific treatment plans while preserving privacy (85). These insights align with a broad body of literature on blockchain in healthcare (24, 29-69).

Limitations: This meta-synthesis primarily relies on qualitative and conceptual literature, lacking quantitative and empirical data, which limits assessment of blockchain's real-world effectiveness. It does not consider country-specific legal, infrastructural, or cultural factors, restricting applicability across diverse healthcare contexts. Exclusion of gray literature and omission of regional or institutional variations further constrain generalizability, especially in low-resource or early-stage digital health environments.

Conclusion

The findings of this study suggest that blockchain technology, beyond being a mere technological tool, functions as a transformative infrastructure capable of playing a pivotal role in redefining healthcare systems. By leveraging core features, such as transparency, security, and decentralization, blockchain has the potential to drive meaningful change not only at the operational level but also in policy-making and system-wide strategic design. Accordingly, this article goes beyond merely identifying potential applications of blockchain; it proposes an analytical framework to guide future actions.

At the operational level, ministries of health and insurance organizations could utilize blockchain to establish national health record systems built around individual data ownership and secure interoperability. Academic institutions and medical education authorities may implement this technology to issue verifiable digital credentials and design adaptive, personalized learning pathways. In the research domain, scientific institutions and research ethics committees can deploy blockchain to structure the processes of data registration, review, and oversight in a transparent and accountable manner. Collectively, these proposals offer practical pathways for translating research insights into implementation and provide a strategic foundation for advancing national digital health initiatives.

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Ethical approval: The present manuscript is a meta-synthesis of previously published literature. Since it does not involve original research with human subjects or animals, no ethical approval was required.

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References

1. Bayyapu S. Blockchain healthcare: Redefining data ownership and trust in the medical ecosystem. International Journal of Advanced Research in Engineering and Technology (IJARET). 2020;11(11):2748-55.
2. Deepa N, Pham QV, Nguyen DC, Bhattacharya S, Prabadevi B, Gadekallu TR, et al. A survey on blockchain for big data: Approaches, opportunities, and future directions. Future Generation Computer Systems. 2022 Jun 1;131:209-26. doi:10.1016/j.future.2022.01.017.
3. Dinh TT, Liu R, Zhang M, Chen G, Ooi BC, Wang J. Untangling blockchain: A data processing view of blockchain systems. IEEE transactions on knowledge and data engineering. 2018 Jan 4;30(7):1366-85. doi:10.1109/TKDE.2017.2781227.
4. Saputra MA, Ochtaffia D, Apriani D, Yusfi SC, Gori M. Blockchain applications in education affecting challenges and problems in digital. Blockchain Frontier Technology. 2023;2(2):15-23. doi:10.34306/bfront.v2i2.155.
5. Dargaoui S, Azrour M, El Allaoui A, Guezzaz A, Benkirane S, Alabdulatif A, et al. Applications of Blockchain in Healthcare. In: Azrour M, Mabrouki J, eds. LOT, Machine Learning and Data Analytics for Smart Healthcare. 1st Ed. Boca Raton, Florida: CRC Press; 2024:1-2. doi:10.1201/9781003430735.
6. Koshechkin KA, Klimenko GS, Ryabkov IV, Kozhin PB. Scope for the Application of Blockchain in the Public Healthcare of the Russian Federation. Procedia Computer Science. 2018 Jan 1;126:1323-8. doi:10.1016/j.procs.2018.08.082.
7. Radanović I, Likić R. Opportunities for use of blockchain technology in medicine. Appl Health Econ Health Policy. 2018 Oct;16(5):583-590. doi: 10.1007/s40258-018-0412-8. [PMID: 30022440]
8. Stagnaro C. White paper: Innovative blockchain uses in health care. Freed Associates. 2017;28:2018.
9. Haryanto SD, Sudaryati E. The ethical perspective of millennial accountants in responding to opportunities and challenges of Blockchain 4.0. Journal of Accounting and Investment. 2020 Aug 14; 21:452-70. doi:10.18196/jai.2103159.
10. Dierksmeier C, Seele P. Blockchain and business ethics. Business Ethics: A European Review. 2020 Apr;29(2):348-59. doi: 10.1111/beer.12259.
11. Leible S, Schlager S, Schubotz M, Gipp B. A review on blockchain technology and blockchain projects fostering open science. Frontiers in Blockchain. 2019 Nov 19;2:16. doi:10.3389/fbloc.2019.00016.
12. Singh B, Rahim MA, Hussain S, Rizwan MA, Bali JK. Unravelling Ethical Dimensions in Blockchain Technology: A Comprehensive Analysis. Proceedings of the 4th IEEE Interdisciplinary Conference on Electrics and Computer; 2024 Jun 11-13; Chicago, United States. 2024: 1-7.
13. Ishmaev G. The Ethical Limits of Blockchain-Enabled Markets for Private IoT Data. Philosophy & Technology. 2020; 33 (3): 411-32. doi:10.1007/s13347-019-00361-y.
14. Casino F, Dasaklis TK, Patsakis C. A systematic literature review of blockchain-based applications: Current status, classification and open issues. Telematics and informatics. 2019 Mar 1;36:55-81. doi:10.1016/j.tele.2018.11.006.
15. Rubeis G. Ethical implications of blockchain technology in biomedical research. Ethik in der Medizin. 2024 Dec;36(4):493-506. doi:10.1007/s00481-024-00805-w.
16. Hazell L, Lawrence H, Friedrich-Nel H. Simulation based learning to facilitate clinical readiness in diagnostic radiography. A meta-synthesis. Radiography (Lond). 2020 Nov;26(4):e238-e245. doi: 10.1016/j.radi.2020.03.006. [PMID: 32249135]
17. Costa V, Monteiro S. Knowledge processes, absorptive capacity and innovation: a mediation analysis. Knowledge and Process Management. 2016 Jul;23(3):207-18. doi:10.1002/kpm.1507.
18. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ. 2009 Jul 21:339:b2535. doi: 10.1136/bmj.b2535. [PMID: 19622551] [PMCID: PMC2714657]
19. Al-Emran M, Mezhuyev V, Kamaludin A, Shaalan K. The impact of knowledge management processes on information systems: A systematic review. International Journal of Information Management. 2018 Dec 1;43:173-87. doi:10.1016/j.ijinfomgt.2018.08.001.
20. Kitchenham B, Charters S. Guidelines for performing systematic literature reviews in software engineering. Department of Computer Science University of Durham: UK, Durham. 2007: 1-57.
21. Shabir G, Burgard W. Integrating blockchain technology in medical education: A new era for students and teachers. [cited 2024 Jul 14]. Available from: URL: https://www.researchgate.net/publication/382240797.
22. Ashraf B, Burgard W. Blockchain technology in scientific studies: impacts on healthcare professionals and medical education. [cited 2024 Jul 14]. Available from: URL: https://www.researchgate.net/publication/382241174.
23. Ilyas M, Yuille A. Medical education and scientific research: the promise of blockchain technology. [cited 2024 Jul 14]. Available from: URL: https://www.researchgate.net/publication/382240809.
24. Ahmad K. Blockchain technology and its implementations in medical and healthcare field. Int J Eng Res Technol. 2020;9(9): 808-813.
25. Moradimokhles H, Pourjamshidi M, Mozafari O. Exploring the role of blockchain technology in medical education: Future opportunities and challenges. Journal of Medical Education Development. 2024 ;17(55):138-53. doi: 10.61186/edcj.17.55.138.

26. Kashyap A, Yadav A, Bajaj V, Khan Y, Arora S, Maini L. Blockchain Technology in Healthcare: The Idea and What Lies Beyond. MAMC Journal of Medical Sciences. 2022 Sep 1;8(3):187-92. doi:10.4103/mamcjms.mamcjms_26_22.
27. Upadhyay S, Agarwal S, Chaudhary A, Singh P, Sharma R. "Blockchain in Healthcare Systems: A Systematic Review. Proceedings of the 2nd International Conference on Disruptive Technologies (ICDT); Greater Noida, India. 2024: 140-7, doi: 10.1109/ICDT61202.2024.10489533.
28. Atadoga A, Elufioye OA, Omaghomi TT, Akomolafe O, Odilibe IP, Owolabi OR. Blockchain in healthcare: A comprehensive review of applications and security concerns. International Journal of Science and Research Archive. 2024 Feb;11(1):1605-13. doi:10.30574/ijsra.2024.11.1.0244.
29. Mijwil MM, Aljanabi M, Abotaleb M, Shukur BS, Al Sailawi AS, Bala I, et al. Exploring the Impact of Blockchain Revolution on the Healthcare Ecosystem: A Critical Review. Mesopotamian Journal of Cybersecurity. 2025 Feb 4;5(1):78-89. doi:10.58496/MJCS/2025/006.
30. Singh Y, Jabbar MA, Kumar Shandilya S, Vovk O, Hnatiuk Y. Exploring applications of blockchain in healthcare: road map and future directions. Front Public Health. 2023 Sep 15:11:1229386. doi: 10.3389/fpubh.2023.1229386. [PMID: 37790716] [PMCID: PMC10543232]
31. Xie Y, Zhang J, Wang H, Liu P, Liu S, Huo T, et al. Applications of blockchain in the medical field: narrative review. J Med Internet Res. 2021 Oct 28;23(10):e28613. doi: 10.2196/28613. [PMID: 34533470] [PMCID: PMC8555946]
32. Saeed H, Malik H, Bashir U, Ahmad A, Riaz S, Ilyas M, et al. Blockchain technology in healthcare: A systematic review. PLoS One. 2022;17(4):e0266462. doi: 10.1371/journal.pone.0266462. [PMID: 35404955] [PMCID: PMC9000089]
33. Esmaeilzadeh P. Benefits and concerns associated with blockchain-based health information exchange (HIE): a qualitative study from physicians' perspectives. BMC Med Inform Decis Mak. 2022;22(1):80. doi: 10.1186/s12911-022-01815-8. [PMID: 35346176] [PMCID: PMC8962111]
34. Niyitunga EB. The current and potential role of blockchain-based technology in managing medical records in Africa. Digital Policy Studies. 2022;1(1):52-68. doi:10.36615/dps.v1i1.1253.
35. Kassab M, DeFranco J, Malas T, Laplante P, Destefanis G, Neto VV. Exploring research in blockchain for healthcare and a roadmap for the future. IEEE Transactions on Emerging Topics in Computing. 2019 Aug 22;9(4):1835-52. doi: 10.1109/TETC.2019.2936881.
36. Alla S, Soltanisehat L, Tatar U, Keskin O. Blockchain technology in electronic healthcare systems. In: Barker K, Berry D, Rainwater C, editors. Proceedings of the 2018 IISE Annual Conference; 2018 May; Orlando, FL. Norcross (GA): IISE; 2018: 1–8.
37. Yaqoob S, Khan MM, Talib R, Butt AD, Saleem S, Arif F, et al. Use of blockchain in healthcare: a systematic literature review. International Journal of Advanced Computer Science and Applications. 2019; 10(5): 644-53. doi: 10.14569/IJACSA.2019.0100581.
38. Sahu H, Choudhari S, Chakole S, Choudhari SG. The use of blockchain technology in public health: lessons learned. Cureus. 2024;16(6):e63198. doi: 10.7759/cureus.63198. [PMID: 39070517] [PMCID: PMC11275554]
39. Mazhar T, Khan S, Shahzad T, Khan MA, Saeed MM, Awotunde JB, et al. Generative AI, IoT, and blockchain in healthcare: application, issues, and solutions. Discover Internet of Things. 2025;5(1):95. doi:10.1007/s43926-025-00095-8.
40. Haleem A, Javaid M, Singh RP, Suman R, Rab S. Blockchain technology applications in healthcare: An overview. International Journal of Intelligent Networks. 2021 Jan 1;2:130-9. doi:10.1016/j.ijin.2021.09.005.
41. Hovorushchenko T, Moskalenko A, Osyadlyi V. Methods of medical data management based on blockchain technologies. J Reliab Intell Environ. 2023;9(1):5-16. doi: 10.1007/s40860-022-00178-1. [PMID: 35646514] [PMCID: PMC9127494]
42. Paul PK, Aithal PS, Bhuimali A, Tiwary KS, Saavedra R, Ghosh S. Emergence of blockchain technologies in digital healthcare: a short review. International Journal of Information Science and Computing. 2021;8(2):59–67. doi:10.30954/2348-7437.2.2021.2.
43. Kimari AM, Niyitunga EB, Jahed MI. The Role of Blockchain Technology in Promoting Health Services in Africa: A Literature Review Perspective. African Journal of Innovation and Entrepreneurship (AJIE). 2024 Apr 1;3(1):185. doi: 10.31920/2753-314X/2024/v3n1a9.
44. Mhamdi H, Ben Othman S, Zouinkhi A, Sakli H. Blockchain technology in healthcare: use cases study. In: Chakraborty C, Khosravi MR, editors. Intelligent Healthcare. Singapore: Springer; 2022: 261-79. doi:10.1007/978-981-16-8150-9_12.
45. Borade S, Paradkar T, Takalkar P, Trivedi A. Blockchain Based Electronic Health Record Management System. [cited 2024 Jul 14]. Available from: URL: https://ssrn.com/abstract=4376765.
46. Almalki T, Alzahrani S, Alhakami W. Healthcare Security based on Blockchain. International Journal of Computer Science & Network Security. 2021;21(8):149-60.
47. Anjum N, Islam L, Chowdhury MR, Alam A. Blockchain applications in healthcare: enhancing data security, interoperability, and fraud prevention. International Journal of Advanced Research in Computer and Communication Engineering. 2025 Feb;14(2):485–93. doi:10.17148/IJARCCE.2025.14266.
48. Aggrey R, Adjirachor E, Adjei BA, Afoduo KO, Dsane NAK, Doe G. The role of blockchain, IoT and AR in future healthcare: a review. International Journal for Multidisciplinary Research. 2024;6(6):1–11. doi:10.36948/ijfmr.2024.v06i06.33535.
49. Chavali D, Dhiman VK, Singiri S, Vootukuri NSR, Uddin SF, Baburajan B. Blockchain for healthcare data management. Int J Pharm Sci. 2024; 2(12):9–14.
50. Agbo CC, Mahmoud QH, Eklund JM. Blockchain technology in healthcare: a systematic review. Healthcare (Basel). 2019 Apr 4;7(2):56. doi: 10.3390/healthcare7020056. [PMID: 30987333] [PMCID: PMC6627742]
51. Ramzan S, Aqdus A, Ravi V, Koundal D, Amin R, Al Ghamdi MA. Healthcare applications using blockchain technology: Motivations and challenges. IEEE Transactions on Engineering Management. 2022 Jul 25;70(8):2874-90. doi:10.1109/TEM.2022.3189734.
52. Revanna N. Blockchain in healthcare. Int Res J Eng Technol. 2020;7(04): 3218-24.
53. Paul AM. Application of blockchain technology in healthcare. Annals of Engineering Mathematics and Computational Intelligence. 2024;1:13–22.
54. Chukwu E, Garg L. A systematic review of blockchain in healthcare: frameworks, prototypes, and implementations. IEEE Access. 2020;8:21196-214. doi: 10.1109/ACCESS.2020.2969881.
55. Elangovan D, Long CS, Bakrin FS, Tan CS, Goh KW, Yeoh SF, et al. The use of blockchain technology in the health care sector: systematic review. JMIR Med Inform. 2022 Jan 20;10(1):e17278. doi: 10.2196/17278. [PMID: 35049516] [PMCID: PMC8814929]
56. Tang D, Liao S, Ding K, Shyu JZ. A strategic overview of blockchain applications in the healthcare. Proceedings of the 2nd

International Conference on Social Science, Public Health and Education (SSPHE 2018); 2018 Nov 16-18; Sanya, China. 2018: 1561-5. doi: 10.2991/ssphe-18.2019.84.
57. Ng WY, Tan TE, Movva PV, Fang AH, Yeo KK, Ho D, et al. Blockchain applications in health care for COVID-19 and beyond: a systematic review. Lancet Digit Health. 2021 Dec;3(12):e819-e829. doi: 10.1016/S2589-7500(21)00210-7. [PMID: 34654686] [PMCID: PMC8510632]
58. Dauda IA, Nuhu BK, Abubakar J, Abdullahi IM, Maliki D. Blockchain technology in healthcare systems: applications, methodology, problems, and current trends. ATBU Journal of Science, Technology and Education. 2021 Apr 21;9(1):431-43.
59. Mann SP, Savulescu J, Ravaud P, Benchoufi M. Blockchain, consent and prosent for medical research. J Med Ethics. 2020 May 4;47(4):244-250. doi: 10.1136/medethics-2019-105963. [PMID: 32366703] [PMCID: PMC8053330]
60. Ekblaw A, Azaria A, Halamka JD, Lippman A. A case study for blockchain in healthcare: "MedRec" prototype for electronic health records and medical research data. Proceedings of the 2nd International Conference on Open and Big Data (OBD 2016); 2016 Aug 22-24; Vienna, Austria. 2016.
61. McGhin T, Choo KK, Liu CZ, He D. Blockchain in healthcare applications: Research challenges and opportunities. Journal of network and computer applications. 2019 Jun 1;135:62-75. doi:10.1016/j.jnca.2019.02.027.
62. Hasselgren A, Kralevska K, Gligoroski D, Pedersen SA, Faxvaag A. Blockchain in healthcare and health sciences—A scoping review. Int J Med Inform. 2020 Feb:134:104040. doi: 10.1016/j.ijmedinf.2019.104040. [PMID: 31865055]
63. Linn LA, Koo MB. Blockchain for health data and its potential use in health IT and healthcare-related research. ONC/NIST Use of Blockchain for Healthcare and Research Workshop. Gaithersburg, Maryland: ONC/NIST; 2016: 8–9.
64. Ben Fekih R, Lahami M. Application of blockchain technology in healthcare: a comprehensive study. In: Jmaiel M, Mokhtari M, Abdulrazak B, Aloulou H, Khemakhem K. Inclusive Smart Cities and e-Health. Cham: Springer; 2020.
65. Hölbl M, Kompara M, Kamišalić A, Nemec Zlatolas L. A systematic review of the use of blockchain in healthcare. Symmetry. 2018 Oct 10;10(10):470. doi:10.3390/sym10100470.
66. Abu-Elezz I, Hassan A, Nazeemudeen A, Househ M, Abd-Alrazaq A. The benefits and threats of blockchain technology in healthcare: A scoping review. Int J Med Inform. 2020 Oct:142:104246. doi: 10.1016/j.ijmedinf.2020.104246. [PMID: 32828033]
67. Khezr S, Moniruzzaman M, Yassine A, Benlamri R. Blockchain technology in healthcare: A comprehensive review and directions for future research. Applied sciences. 2019 Apr 26;9(9):1736. doi:10.3390/app9091736.
68. Kuo TT, Zavaleta Rojas H, Ohno-Machado L. Comparison of blockchain platforms: a systematic review and healthcare examples. J Am Med Inform Assoc. 2019 May 1;26(5):462-478. doi: 10.1093/jamia/ocy185. [PMID: 30907419] [PMCID: PMC7787359]
69. Agbo CC, Mahmoud QH. Blockchain in healthcare: Opportunities, challenges, and possible solutions. International Journal of Healthcare Information Systems and Informatics (IJHISI). 2020 Jul 1;15(3):82-97. doi:10.4018/IJHISI.2020070105.
70. Elo S, Kyngäs H. The qualitative content analysis process. J Adv Nurs. 2008;62(1):107-15. doi: 10.1111/j.1365-2648.2007.04569.x. [PMID: 18352969]
71. Bjelobaba G, Savić A, Tošić T, Stefanović I, Kocić B. Collaborative learning supported by Blockchain Technology as a model for improving the educational process. Sustainability. 2023 Mar 8;15(6):4780. doi: 10.3390/su15064780.
72. Bhaskar P, Tiwari CK, Joshi A. Blockchain in education management: present and future applications. Interactive Technology and Smart Education. 2021 May 19;18(1):1-7. doi:10.1108/ITSE-07-2020-0102.
73. Haque MA, Haque S, Zeba S, Kumar K, Ahmad S, Rahman M, et al. Sustainable and efficient E-learning internet of things system through blockchain technology. E-learning and Digital Media. 2024 May 2;21(3):216-35. doi:10.1177/20427530231156711.
74. Park J. Promises and challenges of Blockchain in education. Smart Learn Environ. 2021;8(1):33. doi: 10.1186/s40561-021-00179-2. [PMID: 40477765] [PMCID: PMC8630989]
75. Wenhua Z, Qamar F, Abdali TA, Hassan R, Jafri ST, Nguyen QN. Blockchain technology: security issues, healthcare applications, challenges and future trends. Electronics. 2023 Jan 20;12(3):546. doi: 10.3390/electronics12030546.
76. Benchoufi M, Ravaud P. Blockchain technology for improving clinical research quality. Trials. 2017 Jul 19;18(1):335. doi: 10.1186/s13063-017-2035-z. [PMID: 28724395] [PMCID: PMC5517794]
77. Omar IA, Jayaraman R, Salah K, Yaqoob I, Ellahham S. Applications of blockchain technology in clinical trials: review and open challenges. Arabian Journal for Science and Engineering. 2020 Apr;46(4):3001-15. doi:10.1007/s13369-020-04989-3.
78. Machado TB, Ricciardi L, Oliveira MB. Blockchain technology for the management of food sciences researches. Trends in Food Science & Technology. 2020 Aug 1; 102:261-70. doi:10.1016/j.tifs.2020.03.043.
79. Maslove DM, Klein J, Brohman K, Martin P. Using blockchain technology to manage clinical trials data: a proof-of-concept study. JMIR Med Inform. 2018 Dec 21;6(4):e11949. doi: 10.2196/11949. [PMID: 30578196] [PMCID: PMC6320404]
80. Sapci AH, Sapci HA. Artificial intelligence education and tools for medical and health informatics students: systematic review. JMIR Med Educ. 2020 Jun 30;6(1):e19285. doi: 10.2196/19285. [PMID: 32602844] [PMCID: PMC7367541]
81. Yeung K. The health care sector's experience of blockchain: A cross-disciplinary investigation of its real transformative potential. J Med Internet Res. 2021 Dec 20;23(12):e24109. doi: 10.2196/24109. [PMID: 34932009] [PMCID: PMC8726042]
82. Shuaib K, Saleous H, Shuaib K, Zaki N. Blockchains for secure digitized medicine. J Pers Med. 2019 Jul 13;9(3):35. doi: 10.3390/jpm9030035. [PMID: 31337080] [PMCID: PMC6789651]
83. Zhou L, Wang L, Sun Y. MIStore: a blockchain-based medical insurance storage system. J Med Syst. 2018 Jul 2;42(8):149. doi: 10.1007/s10916-018-0996-4. [PMID: 29968202] [PMCID: PMC6028902]
84. Bathula A, Gupta SK, Merugu S, Saba L, Khanna NN, Laird JR, et al. Blockchain, artificial intelligence, and healthcare: the tripod of future—a narrative review. Artificial Intelligence Review. 2024 Aug 8;57(9):238. doi:10.1007/s10462-024-10873-5.
85. Udegbe FC, Ebulue OR, Ebulue CC, Ekesiobi CS. AI's impact on personalized medicine: Tailoring treatments for improved health outcomes. Engineering Science & Technology Journal. 2024 Apr 17;5(4):1386-94. doi:10.51594/estj.v5i4.1040.

Table 1. Keyword search

Keyword search
Blockchain Technology AND Medical Education AND Healthcare Innovation AND Medical Research AND Blockchain Applications; Blockchain Technology OR Medical Education OR Healthcare Innovation OR Medical Research OR Blockchain Applications(Blockchain Technology AND Medical Education) OR (Blockchain Technology AND Medical Research) OR (Blockchain Technology AND Healthcare Innovation); (Blockchain Applications AND Medical Education) OR (Blockchain Applications AND Healthcare Innovation); (Blockchain Technology OR Blockchain Applications) AND (Medical Education OR Medical Research OR Healthcare Innovation)

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Must involve blockchain systems in medical education, medical research, and healthcare, must involve research framework, must qualitative research, must be written in English language, must be published between 2008 and 2025	Articles on blockchain systems but not in medical field, Articles without research framework, Articles published in languages other than English

Table 3. Quality assessment results

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Total
(21)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(22)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(23)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(24)	Yes	No	Partially	Yes	Yes	Partially	Yes	5.0/7
(25)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(26)	Yes	No	Yes	Yes	Yes	Yes	Yes	6.0/7
(27)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(28)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(29)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(30)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(31)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(32)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(33)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(34)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	7.0/7
(35)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(36)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(37)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(38)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(39)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(40)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(41)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(42)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(43)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(44)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(45)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(46)	Yes	Partially	Yes	Yes	Partially	Yes	Partially	5.5/7
(47)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(48)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(49)	Yes	Partially	Yes	Yes	Yes	Yes	Yes	6.5/7
(50)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(51)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(52)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(53)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(54)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(55)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(56)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(57)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7

(58)	Yes	Partially	Yes	Yes	Yes	Yes	Partially	6.0/7
(59)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(60)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(61)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(62)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(63)	Yes	Partially	Yes	Yes	Yes	Yes	Yes	6.5/7
(64)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(65)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(66)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(67)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(68)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7
(69)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7.0/7

The quality of the included studies was evaluated based on a three-point scoring system, where each criterion was rated as 1 (Yes) if fully met, 0.5 (Partially) if partially met, and 0 (No) if not met at all. Studies scoring above 4 out of 7 were considered eligible for further analysis, while those scoring 4 or below were excluded due to insufficient methodological rigor or relevance.

Table 4. Blockchain applications in medical education

Main themes	Key concepts	Frequency
Secure, transparent, and efficient management of academic records.	Secure and transparent recording of academic information (21, 22, 32); Reliable credential verification (21, 23); Creation of immutable records for performance and certifications (21); A secure system for issuing, managing, and integrating academic credentials (21); Streamlining the credential issuance process (21); Digital identity management for students (21, 54); Employer access to verified qualifications (22); Reducing the cost of issuing academic credentials (22); Recording educational activities in a digital resume (21); Developing blockchain-based curricula, content tracking, and assessment (36); Managing student enrollment data (51).	15
Personalized, adaptive, and data-driven learning.	Personalization of learning experiences and content (21, 22); Identification of educational needs, areas requiring support, and learning styles (21, 22); Adapting programs to student progress and competencies (21, 22); Adaptive and customized learning (22); Self-regulation and adjustment of learning strategies (21); Support for continuous tracking of individual progress (21, 22); Analysis of student performance data (22); Design of targeted educational programs (21).	12
Collaborative, social, and interactive learning in a metaverse environment.	Facilitating collaborative and shared learning (21, 22); Real-time peer-to-peer interaction (21); Enabling the sharing of resources and information (21); Strengthening the sense of community, collaboration, and teamwork (31); Providing opportunities for effective mentoring (21); Simulated and interdisciplinary learning (21); Development of educational scenarios and dynamic interactive environments (21).	8
Continuous, real-time, and performance data-driven assessment.	Tracking student progress and achievements (31, 32, 42); Continuous assessment of progress and performance (31); Secure recording of performance metrics and learning outcomes (31); Real-time and periodic feedback (31, 32, 42); Secure and anonymous student assessments (31); Self-assessment by students and faculty members (31); Enhancing the accuracy of educational decision-making (31, 43, 59); Providing feedback on educational programs (42).	14
Development of key professional and interpersonal skills.	Critical thinking, problem-solving, and decision-making (21); Development of teamwork skills (21); Fostering a growth mindset and self-development (21); Exploratory learning and gamification (21); Promoting a culture of lifelong learning (21, 22, 32); Growth of online learning (51); Encouraging active engagement and continuous learning (21, 22); Enhancing self-development skills (21).	11
Optimization of educational processes and enhancement of institutional efficiency.	Reducing educational workload and accelerating tasks (22); Enhancing efficiency and productivity in education (22, 51); Improving the quality of the learning experience (21); Supporting the design of more effective curricula (21); Enhancing the accuracy of informed educational decision-making (21, 33, 49); Developing educational strategies (21); Credentialing and validation of course content (36); Supporting curriculum evaluation (36).	11

Table 5. Blockchain applications in medical research

Main themes	Key concepts	Frequency
Security, transparency, and integrity of research data.	Immutable recording of research data (22); Tamper-proof and traceable data (23); Integrity of research data (22, 28, 32); Improved reliability and accuracy of research data (22); Auditability and traceability in scientific research (22, 23); Transparency in collaborative research projects (22, 23); Enabling stakeholders to track data origins and monitor changes over time (22); Preserving confidentiality in medical research data (23); Protecting intellectual property rights in research (23).	12
Inter-institutional and interdisciplinary collaboration in research.	Strengthening collaboration among researchers (23, 26, 57); Fostering a culture of research collaboration (22); Enhancing interaction between researchers and patients in studies (55); Creating a collaborative environment for researchers (22); Promoting interdisciplinary approaches in academic research (22); Establishing a shared data repository (22); Developing a common language for data exchange in research (33); Sharing data and insights across research institutions (22); Enabling data sharing within clinical teams and between physicians and researchers (62).	11
Trust, ethics, and research accountability.	Increasing trust in research findings (22, 55); Confidence in clinical actions and data-driven decision-making (22); Promoting research ethics (22); Fostering a culture of research integrity (22); Strengthening research accountability (22); Preventing the generation of fabricated data (22); Building a culture of trust in research (22); Establishing trust among research teams (22); Enhancing the reproducibility of studies (22, 23, 50); A reliable mechanism to accelerate clinical trials (24, 36).	14
Automation, productivity, and efficiency in research processes.	Automating various research functions (22); Enhancing research productivity (40, 53); Reducing the cost of clinical trials (34); Accelerating academic research (22, 34); Boosting the pace of innovation in research (22); Improving the quality of research (22, 26, 34); Increasing research efficiency (51); Ecosystem-level support for research outputs (24); Public sharing of research findings (22); Timely interventions based on research results (22).	14
Support for research design and analytical methods.	Supporting the precise design of research methodologies (22); Helping researchers conduct deeper analyses (22); Performing advanced analytics in research (51, 67); Developing data collection methods (60); More innovative and reliable research methodologies (38); Strategic alignment of research direction (60); Discovering new ways to process research data (59); Innovation in research (22, 47); Transforming research objectives (60); Supporting feasibility studies for implementing research outcomes (63); Assisting researchers in accessing population- level insights for medical treatment (63).	13
Research data management	Research data management (22, 59); Updating research data (22); Fast and secure access to longitudinal research data (37); Open access to data in research (51); Timely access to research data (22); Generating big data for research (23); Improving the quality and quantity of data for medical research (61).	8
Clinical trial development	Clinical trial data management (34, 55, 59); More precise monitoring of clinical trials (47); Management of clinical testing processes (24); Traceability of clinical trial phases (58); Simulation of clinical trials (34); Automation of clinical data processing (34); Integration of clinical trial processes (43); Transparency in clinical trial data reporting (32, 44).	11
Governance and oversight in research.	Effectiveness in monitoring research processes (22); Management of research licensing (37); Administration of academic research (56); Transforming the peer review process for clinical research publications (50); Monitoring clinical research activities (53); Supporting compliance with research regulatory requirements (22); Sharing data with regulatory bodies (28); Monitoring individual clinical data in research (58).	8

Table 6. Blockchain applications in healthcare

Main themes	Key concepts	Frequency
Health data and records management.	Medical records management (24, 29, 30, 33, 37, 38, 40, 43, 44, 48, 50, 52, 56, 68); Healthcare data management (44, 48, 49, 54, 56); Storage, access control, and data sharing (24, 30, 32, 33, 38, 39, 42-47, 50, 51, 53, 54, 61-64, 66, 67); Integration of medical data (64); Easy retrieval of treatment information (34); Development of digital health applications (32); Patient access to their medical data and records (34, 40, 41, 48, 49, 50-52, 60, 68); Data traceability among stakeholders (29, 44, 54, 58, 64, 68); Establishing a global system for data sharing (50, 51, 53).	63

Security, privacy, and authenticity of information.	Enhancing the security and privacy of healthcare data (24, 31-38, 40-45, 46-51, 53, 55-57, 63, 67, 68); Securing patient information (35); Preventing incorrect billing (28); Reducing the risk of human error in data entry and processing (37); Identifying risks of patient data theft or manipulation of medical records (53); Combating forged electronic prescriptions (52); Preventing falsified informed consent forms (53); Managing patient consent (67, 28).	34
Pharmaceutical supply chain.	Tracking the authenticity of pharmaceuticals in the supply chain (28, 43); Verifying the authenticity of medications (28); Reducing the risk of counterfeit drugs entering the market (28-30, 32, 35-39, 43, 47, 50, 67); Enhancing transparency and trust among all stakeholders (30, 31, 35-37, 39, 49, 55, 59, 63, 68, 69); Providing a platform to track the production, distribution, and sale of medications (27-29, 31, 32, 36-38, 42, 49, 51-53, 57, 58, 63, 66, 68); Digital proof of pharmaceutical intellectual property ownership (24); Improving supply chain efficiency through automation and reduced reliance on intermediaries (24, 28, 58); Reducing costs in the production and distribution process (28, 40, 58); Innovating the pharmaceutical supply chain (28); Aligning supply and demand within the pharmaceutical supply chain (29, 35, 36, 38, 42, 47, 50, 57); Digitalization and integration of the pharmaceutical supply chain (29); Supporting pharmaceutical after-sales services (56).	62
Telemedicine and digital health services.	Telemedicine and remote monitoring (28, 32, 36, 46, 48, 50, 57, 58, 62, 63); Remote feedback to the clinical team (26, 62); Development of virtual consultation services and online platforms (32, 42); Providing real-time emergency services (32, 63).	16
Development of insurance and billing processes.	Improving the insurance claims and complaints process (24, 25, 28, 34, 36-38, 49, 64, 68); Management of medical insurance (66); Claims and billing management (24, 28, 67); Automation of all medical billing operations (30); Reducing costs and bureaucracy in the healthcare system (33, 46, 47, 49, 55, 65).	20
Improved clinical decision-making and personalized treatment.	Clinical decision support systems (29, 31, 49); Improving diagnostic accuracy and treatment effectiveness (31, 36); Accurate prediction of drug effects (40); Supporting the review of treatment plans (40); Personalization of treatment programs (40, 63); Clear and transparent access to the latest treatment information (26, 45); Reducing the occurrence of medical errors (27, 35, 43, 49); Patient-centered approach in healthcare (30, 31, 35, 38, 49, 54); Enhancing coordination in healthcare delivery (30, 36, 43); Improving patient satisfaction outcomes (30, 39, 40, 49, 52); Increasing the capacity for informed decision-making in the healthcare system (31, 33, 55, 68); Real-time monitoring and disease control (39, 61, 63, 67).	37
Interoperability and data exchange in healthcare.	Institution-centered interoperability (24, 34, 36, 38, 42, 47, 50, 53, 56, 60-62, 66, 69); Patient-centered interoperability (24); Development of immutable data protocols and a global data-sharing ecosystem (49-51, 53).	19
Smart transformation and digitalization of the healthcare system	Digitalization and integration of the healthcare system (29, 41, 47, 56); Intelligent healthcare system development (51, 67); Development of blockchain-based mobile health applications (51); Creating innovative models for data sharing (41, 42, 46, 55); Innovating disease detection processes (34); Automating and accelerating administrative processes (28, 40, 47, 65); Managing conflicts and disputes (28, 40); Adopting digital models of healthcare (39); Supporting data-driven decision-making (31); Cost management and financial planning in the healthcare system (33, 40, 46, 49, 55).	25
Continuous health monitoring, supervision, and evaluation.	Health record auditing (26); Continuous patient health monitoring without disrupting daily life (31); Tracking patient interactions with the healthcare system (26, 43); Development of timely medical alerts (33); Effective monitoring of electronic medical data (27); Digital tracking, management, and surveillance of pandemic outbreaks (27, 32, 39, 53); Data sharing with regulatory authorities (28).	11

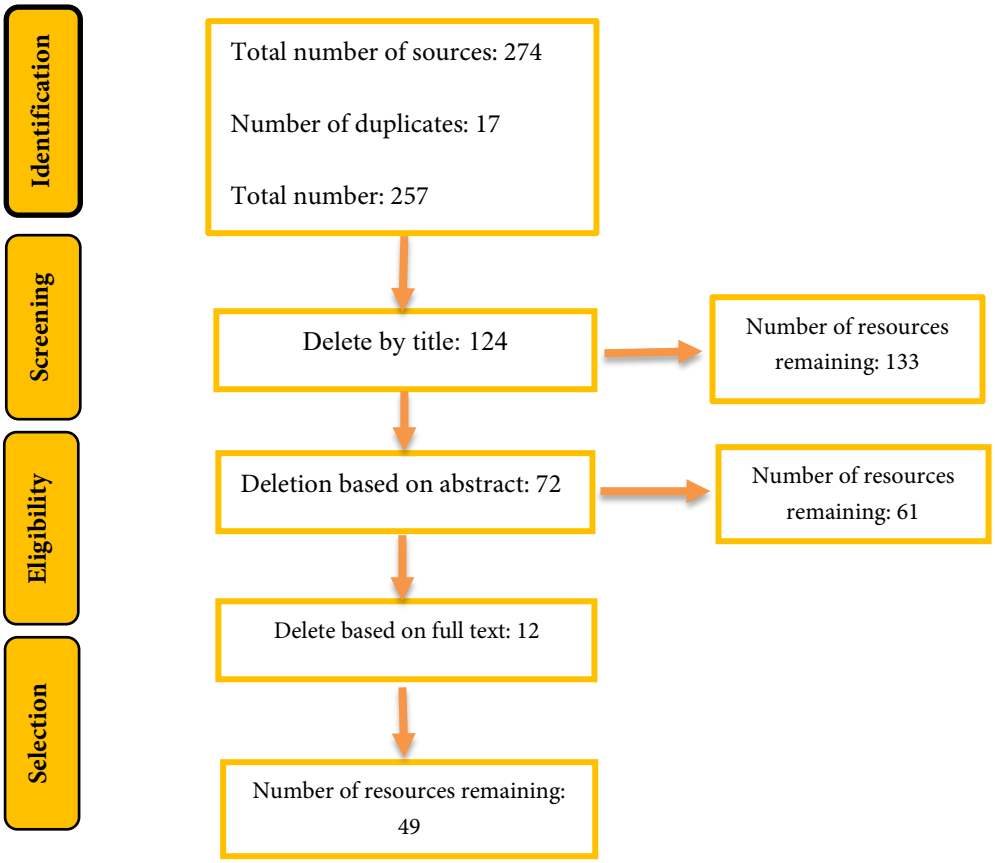

Figure 1. The PRISMA flow diagram

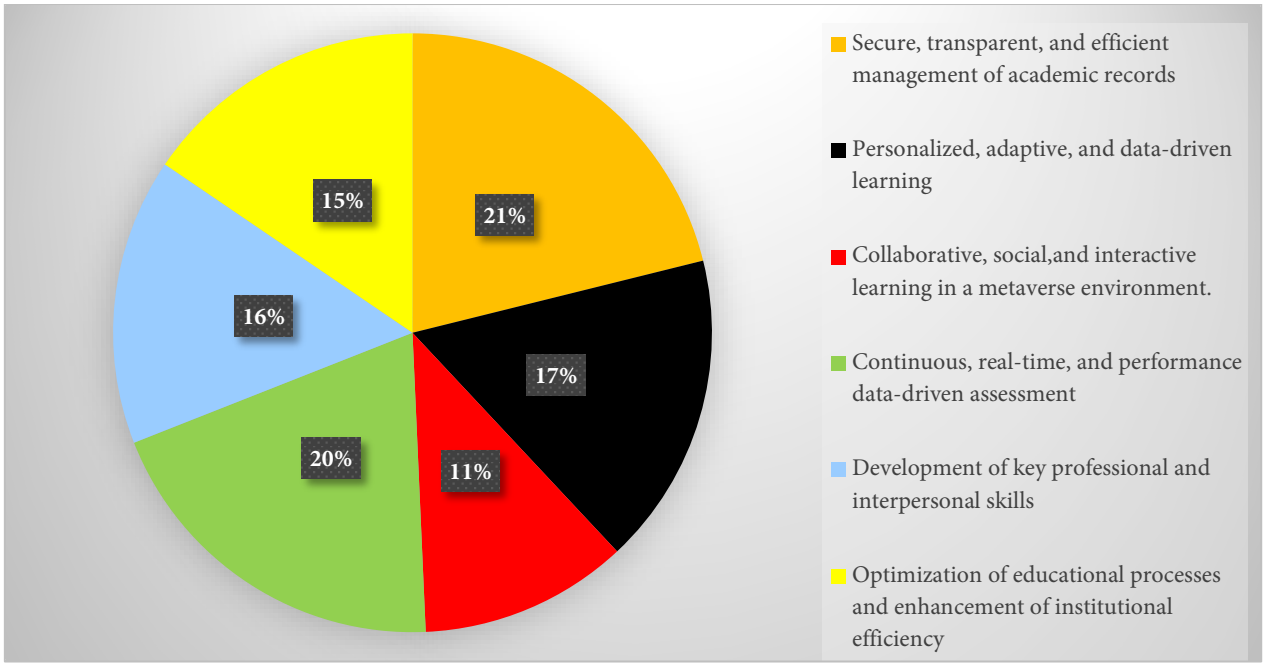

Figure 2. Blockchain applications in medical education

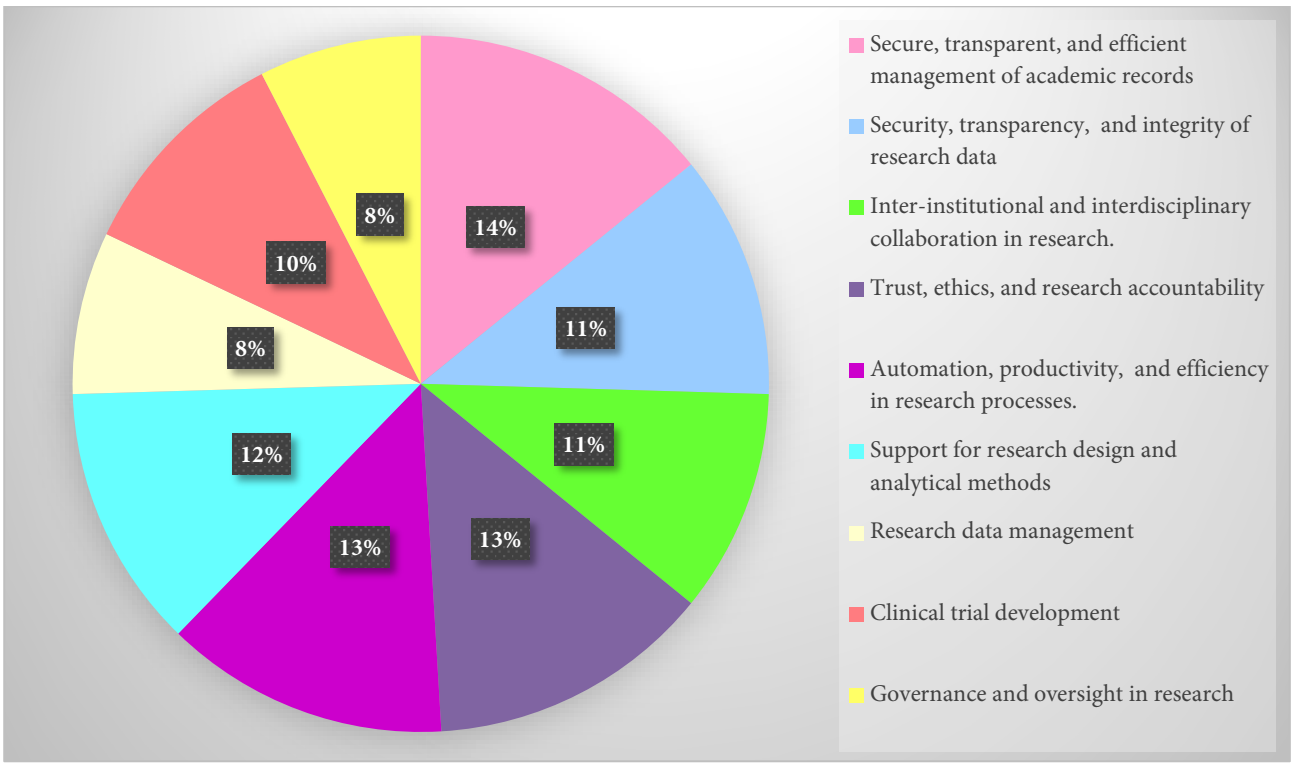

Figure 3. Blockchain applications in medical research

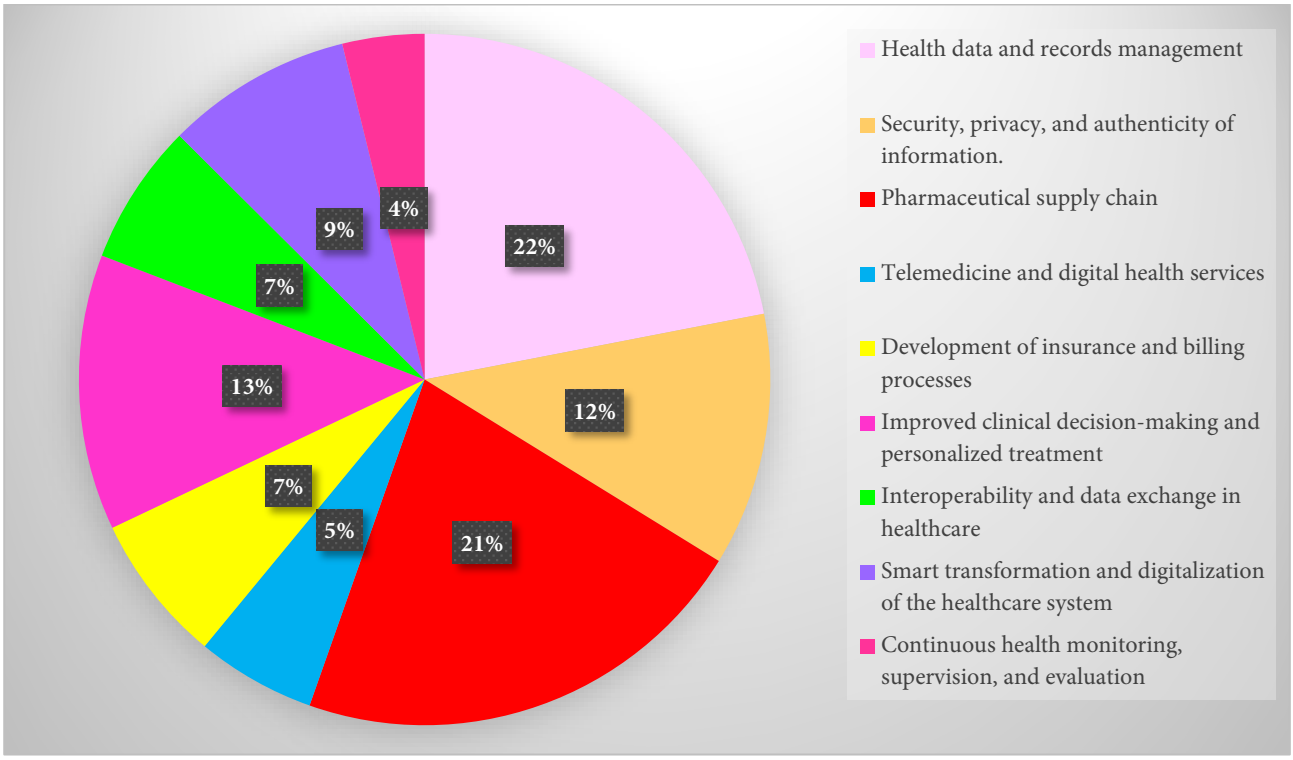

Figure 4. Blockchain applications in healthcare

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Viewpoint

Integrating Microteaching into Postgraduate Programs for Enhancing the Teaching Role of Medical Residents

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Abstract

Background: The residency period is required not only to acquire specialty-specific knowledge and skills but also to grow as clinicians, mentors, and leaders within their medical communities.

Objectives: The objectives of the current article are to identify the existing gaps in the role of residents as teachers, formulate a stepwise plan for the implementation of microteaching for residents, ascertain challenges in implementing microteaching among residents, and propose targeted solutions to overcome these identified challenges.

Methods: This viewpoint was developed by searching published literature on resident-led teaching and microteaching practices in postgraduate medical education. Moreover, practical suggestions were proposed, keeping in mind the contextual challenges reported in medical institutions.

Results: To master these roles, residents must engage in teaching-related activities, which can be directed to their peers, junior residents, interns, or undergraduate students. Most postgraduate residency programs lack a structured teaching-skills training component. Acknowledging the fact that skilled resident teachers can immensely contribute to the vision and mission of the Institute, there is a definite need to give them opportunities to teach and refine their skills. There lies the need to introduce a structured microteaching program for residents to improve their teaching skills.

Conclusion: In conclusion, postgraduate residents are given a limited number of opportunities to improve their teaching skills during the residency period, and introducing microteaching for them could help immensely in preparing them for their roles as teachers. The need of the hour is to adopt a stepwise plan, encompassing the involvement of all stakeholders, to derive maximum benefits and create a robust educational environment in residency programs.

Keywords: Microteaching; Feedback; Residents; Teaching; Lesson Plan; Peer learning; Competency; Mentors; Postgraduates

Background

The residency period is not only meant to acquire speciality-specific knowledge and skills but also to grow as clinicians, mentors, and leaders within their medical communities (1). To master these roles, residents must engage in teaching-related activities directed toward peers (peer learning), junior residents, interns, undergraduate students (near-peer learning), and patients for improving their understanding of the diagnosis and the management plan (2, 3). The findings of a systematic review revealed that the residents who teach and explain concepts to others retain knowledge better and even develop a grasp of the subject (3). The results of a survey done among internal medicine residents in the United States reported that they find it challenging to identify feedback in the teaching context (4). In addition, residents engaged in teaching tend to think critically and adopt a systematic approach while dealing with their patients, which plays a vital role in strengthening their diagnostic and clinical reasoning (4).

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The findings from a cross-sectional survey done to assess the interpersonal and communication skills of Anesthesiology residents highlighted the need to improve their communication skills, which is crucial for effective teamwork and interprofessional collaboration required for patient care (5). Further, residents become confident in their judgment, as they have to respond to questions or clear doubts of different stakeholders and make informed decisions, eventually preparing them for independent practice (6). Residents who are engaged in regular teaching are generally motivated to stay abreast of recent developments and thus remain committed to lifelong learning (7). Moreover, as residents teach others, they lead, mentor, and inspire others, thereby learning the skill of effective leadership and mentorship within their healthcare teams (2-4). The objectives of the current article are to identify the existing gaps in the role of residents as teachers, formulate a stepwise plan for the implementation of microteaching for residents, ascertain challenges in implementing microteaching among residents, and propose targeted solutions to overcome these identified challenges.

Residents as Teachers: Current gaps

The teaching skills are not given priority mainly due to the heavy clinical workloads and long working hours that do not allow adequate time for residents to focus on developing their teaching skills (8). In many nations, once postgraduate residents complete their training program, they can join the faculty in the capacity of a faculty member to train undergraduate students without being exposed to any pedagogical training program. It is a fact that most postgraduate residency programs do not have a structured teaching-skills training component (9). Furthermore, teaching competencies are often not considered core competencies, due to which they are never ready for teaching responsibilities, neither during the residency period nor for their future professional careers (9, 10). It is not an unknown phenomenon that if we want to improve teaching skills, we have to give an adequate number of opportunities for the residents/teachers to practice (11). However, such teaching opportunities in a structured manner are rarely provided to the residents, and this immensely limits their skill development (8, 11).

Commonly, many residents lack mentors who are strong teachers themselves. In the absence of effective role models, these residents often struggle to understand and develop skills required for effective teaching in both classroom and clinical settings (8). Whatever teaching skills a postgraduate resident acquires are via informal interactions, targeting predominantly just the peers, which makes the quality of teaching inconsistent (2, 3). Moreover, in the absence of a structured teaching program, residents don't receive feedback on their teaching skills and thus fail to realise which areas they are doing well in and where they need more work (9, 10). In addition, the teaching skills of residents are not even assessed, and that makes it difficult for residents to measure their growth as teachers (12). All these factors clearly explain the limitations in the existing postgraduate medical curriculum, owing to which residents are not prepared for their roles as teachers (9, 10).

In a study done in Taiwan, involving experts from teaching hospitals and public medical centres, 20 experts participated in developing a competency-based framework which can be implemented for the benefit of residents-as-teachers and is in alignment with the Accreditation Council for Graduate Medical Education (13). This collaborative work eventually concluded with two core competencies, namely instruction and assessment, which further had three sub-competencies (viz. dissemination of knowledge, teaching of procedural skills, and direct observation and feedback) (13). In another study done at the Aga Khan University Hospital among enrolled family medicine residents to assess the efficacy of the dermatology course delivered via blended learning, it was reported that a significant improvement in post-test scores was obtained in comparison with pre-test scores (14). In continuation, it was concluded that blended learning is an effective and innovative teaching strategy to aid residents in improving their learning (14).

Stepwise plan for the implementation of microteaching for residents

Acknowledging the fact that skilled resident teachers can immensely contribute to the vision and mission of the Institute, there is a definite need to give them opportunities to teach and refine their skills (15). There is a need to introduce a structured microteaching program for residents to improve their teaching skills, but its successful implementation will depend on the adoption of a structured program (16). This begins with defining the purpose of the initiative (viz., enhancement of teaching skills, improved communication skills, delivery of effective feedback, etc.), as depicted in Figure 1 (15, 16).

Accordingly, specific teaching-related techniques (like case presentations, demonstration of procedures on real patients or in skills lab, patient education, etc.) should be incorporated into the curriculum, and realistic resources that are in alignment with the resident year of training should be developed to be used during microteaching sessions (16, 17). These sessions can be integrated with the residency schedule without causing any disruption to the existing training program, and faculty or senior residents can be preferably assigned for each session, just like any other postgraduate learning activities (17, 18). For instance, in a retrospective record-based study done among postgraduate residents, where microteaching has been integrated into the residency schedule, it was reported that most teaching skills were satisfactory. Still, students lacked the skills of interaction and summarization of the topic (17).

Before the session, residents should be informed about the goals, structure, and expectations (prepare a short teaching session and target a single and clearly defined learning objective) (16). The microteaching session should be implemented as per the standard norms (like for faculty members), and if possible, it should be video recorded to promote reflection (18). After each such session, constructive feedback should be given, and residents should be encouraged to reflect on their teaching session. Accordingly, real-time improvements should be made (18, 19). Residents should be given time to practice, and then the same cycle is repeated, where residents have incorporated the given feedback (17). There is a possibility that rubrics are developed to grade the performance of residents, and feedback should also be obtained from participating residents on the overall session (19, 20). Teachers and instructors should review the obtained feedback and make improvements in the program for future sessions to benefit residents and improve their teaching skills (19, 20).

Identified challenges and Potential solutions

Organizing microteaching sessions for residents in medical institutions is expected to encounter some challenges, as listed in Table 1 (15-22). The most important concern is finding dedicated time for microteaching sessions within the existing curriculum for postgraduate residents from all specialties (16, 17). However, the effectiveness of such sessions will depend upon the facilitators who are trained in giving constructive feedback and running a microteaching session as per the standards (18). Another primary concern has been the resistance from residents to participate in microteaching sessions, where they might have anxiety about public speaking or peer feedback (16, 17). Further, the process of developing a consistent and structured assessment tool to measure the performance of residents can also turn out to be a tough ask (19). Finally, there could be lots of administrative and logistical constraints that could interfere with the implementation (19, 20).

This calls for the need to devise a stepwise plan, train facilitators, sensitize residents, and convince administrators to support the initiative to implement the program for all postgraduate residents (Table 1) (15-22). To bridge the scarcity of studies that examine the factors contributing to the self-efficacy and teaching performance of student teachers, a survey was conducted among 272 English-as-a-foreign-language student teachers (15). This study aided in the creation of a theoretical framework which can assist decision-makers in encouraging facilitators and overcoming barriers in microteaching programs (15). In a pilot study based on the findings of three microteaching sessions in India, all participants found the training sessions to be helpful in improving their teaching skills and also in improving their performance in semester examinations (16). In a study to evaluate the five-day resident-as-teacher training programme in the United States, significant improvements were reported in self-reported comfort and confidence with teaching, and peer observation was reported as the most crucial component of the entire training course (21). In the future, there is a definite need for both qualitative and quantitative evaluation of the existing program and for measuring the impact of teaching improvement on patient care and learner educational outcomes, as this can improve the overall quality of the microteaching programs.

Conclusion

In conclusion, microteaching is a structured and practical approach to improve the teaching skills of postgraduate residents, yet it remains underutilized. The process of integrating microteaching into residency programs aligns with the principles of competency-based medical education. However, for effective implementation, institutional administrators must allocate protected time, train faculty in their role as facilitators, and formally recognize teaching in residency assessment.

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References

1. Hernandez RG, Hopkins A, Dudas RA. The evolution of graduate medical education over the past decade: Building a new pediatric residency program in an era of innovation. Med Teach. 2018 Jun;40(6):615-621. doi: 10.1080/0142159X.2018.1455969. [PMID: 29658367]
2. Sotsky J, Senter MS, Golkin E, Cabaniss DL. No fear of near peer: How resident teachers can boost a program in Psychiatry. Acad Psychiatry. 2022;46(4):500-3. doi: 10.1007/s40596-021-01462-7. [PMID: 33942239]
3. Pethrick H, Nowell L, Paolucci EO, Lorenzetti L, Jacobsen M, Clancy T, et al. Peer mentoring in medical residency education: A systematic review. Can Med Educ J. 2020 Dec 7;11(6): e128-e137. doi: 10.36834/cmej.68751. [PMID: 33349761] [PMCID: PMC7749692]
4. Matthiesen MI, Baker K, Shapiro J, Chang Y, Buskirk TD, Wright DE. Resident identification of feedback and teaching on rounds. Proc (Bayl Univ Med Cent). 2019 Aug 5;32(4):525-528. doi: 10.1080/08998280.2019.1641046. [PMID: 31656410] [PMCID: PMC6793959]
5. Casabianca AB, Berger JS, Papadimos TJ, Capwell-Burns A. The effect of previous resident interactions on the assessment of interpersonal and communication skills by teaching faculty: Are we the best evaluators? J Educ Perioper Med. 2015 Jul 1;17(1):E001. [PMID: 27175407] [PMCID: PMC4797728]
6. Sederberg M, Liem B, Tarkhan A, Gessel T, LaCourse M, Latzka E. Brief ultrasound-aided teaching to improve the accuracy and confidence of resident musculoskeletal palpation. PM R. 2020 Apr;12(4):391-396. doi: 10.1002/pmrj.12246. [PMID: 31448538]
7. Fortenberry KT, Cochella S, Stoesser K, Ose D, Taylor E, Frame KA, et al. Teaching self-directed learning skills through a resident-led milestones process. PRiMER. 2022 Sep 21:6:321624. doi: 10.22454/PRiMER.2022.321624. [PMID: 36632491] [PMCID: PMC9829004]
8. Pacifico JL, Donkers J, Jacobs J, van der Vleuten C, Heeneman S. Understanding teaching and learning conceptions among clinical faculty as a means to improve postgraduate training. Int J Med Educ. 2020 Aug 28:11:175-185. doi: 10.5116/ijme.5f2a.76eb. [PMID: 32857063] [PMCID: PMC7882127]
9. Chang E, Johnson PN, Medina MS, Dennis VC, Neely SB, Miller JL. Sculpting a teaching and learning curriculum to better meet the career needs of postgraduate year 1 and 2 pharmacy residents. Am J Health Syst Pharm. 2023 Jun 7;80(12):765-71. doi: 10.1093/ajhp/zxad057. [PMID: 36971249]
10. Sheehan AH, Sprunger TL, Viswesh V, Gettig JP, Boyle J. The current landscape of college-sponsored postgraduate teaching and learning curriculum programs. Am J Pharm Educ. 2020 Jul;84(7):ajpe7803. doi: 10.5688/ajpe7803. [PMID: 32773833] [PMCID: PMC7405296]
11. Stephan A, Cheung G. Clinical teaching and supervision in postgraduate psychiatry training: The trainee perspective. Australas Psychiatry. 2017 Apr;25(2):191-197. doi: 10.1177/1039856216679539. [PMID: 27879425]
12. Joshi MK. Novel teaching-learning and assessment tools to complement competency-based medical education in postgraduate training. Indian J Anaesth. 2024 Jan;68(1):11-16. doi: 10.4103/ija.ija_1175_23. [PMID: 38406330] [PMCID: PMC10893807]
13. Liang JF, Hsu TF, Chen CY, Yang CW, Jean WH, Ou LS, et al. Developing a competency-based framework for resident-as-teacher. J Formos Med Assoc. 2022 Oct;121(10):1956-1962. doi: 10.1016/j.jfma.2022.01.027. [PMID: 35151563]
14. Masood S, Bhombal ST, Ghulam U. Blended learning: An innovative teaching strategy to teach dermatology to the family medicine residents of a teaching hospital. J Family Med Prim Care. 2024 Sep;13(9):3571-3575. doi: 10.4103/jfmpc.jfmpc_1837_23. [PMID: 39464920] [PMCID: PMC11504814]
15. Luo Z, Li H. Competence, preparation, and relaxation: Contributing factors to EFL student teachers' self-efficacy and teaching performance in microteaching training. Heliyon. 2024 Feb 17;10(4):e26216. doi: 10.1016/j.heliyon.2024.e26216. [PMID: 38420441] [PMCID: PMC10900927]
16. Muthukrishnan SP, Mehta N. Microteaching enhances teaching skills of resident doctors in India: A pilot study. Natl Med J India. 2019 Jan-Feb;32(1):29-31. doi: 10.4103/0970-258X.272114. [PMID: 31823938]
17. Deshpande SR, Shastri S. A cross-sectional study to evaluate teaching skills of postgraduate medical students using component skill approach in microteaching. J Educ Health Promot. 2020 Dec 29:9:362. doi: 10.4103/jehp.jehp_743_19. [PMID: 33575398] [PMCID: PMC7871963]
18. Dayanindhi VK, Hegde SP. Effectiveness of microteaching as a method of developing teaching competence among in-service medical teachers. J Adv Med Educ Prof. 2018 Oct;6(4):155-161. [PMID: 30349826] [PMCID: PMC6191834]
19. Thangaraju P, Medhi B. Microteaching: Overview and examination evaluation. Indian J Pharmacol. 2023 ;55(4): 257-262. doi: 10.4103/ijp.ijp_912_21. [PMID: 37737079] [PMCID: PMC10657622]
20. Santosh AB, Gabbadon C. Dental education: Microteaching. J Dent Educ. 2010 Nov;74(11):1243-4. [PMID: 21045230]
21. Ricotta DN, Hale AJ, Freed JA, Taylor JL, Smith CC. Peer observation to develop resident teaching. Clin Teach. 2020 Oct;17(5):521-525. doi: 10.1111/tct.13134. [PMID: 31968153]
22. Grabski DF, Goudreau BJ, Gillen JR, Kirk S, Novicoff WM, Smith PW, et al. Compliance with the Accreditation Council for Graduate Medical Education duty hours in a general surgery residency program: Challenges and solutions in a teaching hospital. Surgery. 2020 Feb;167(2):302-307. doi: 10.1016/j.surg.2019.05.029. [PMID: 31296432] [PMCID: PMC7329367]

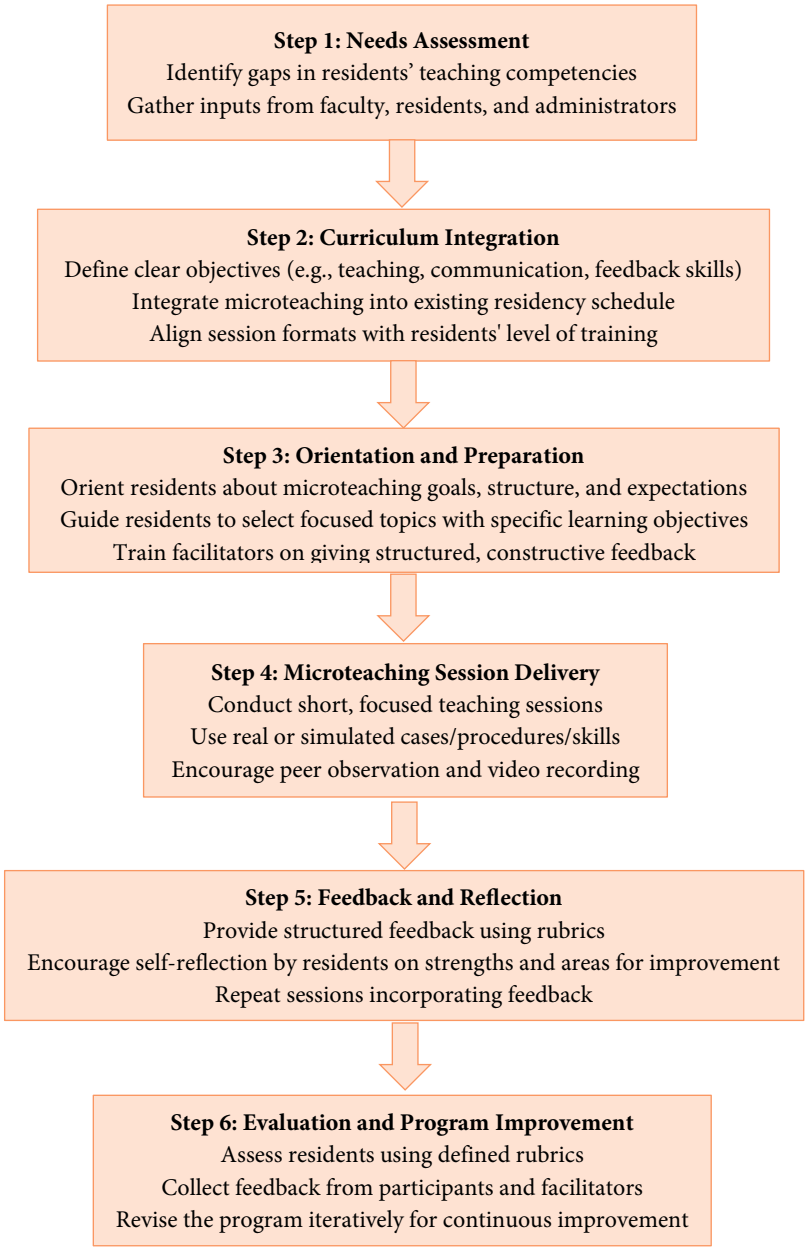

Figure 1. Step-wise plan for microteaching implementation

Table 1. Identified challenges and potential solutions

Identified Challenges	Potential Solutions
Time constraints	Integrate microteaching into existing schedule of postgraduate activities through cross-scheduling to minimize disruption to clinical duties
	Keep the duration of sessions brief (5–10 minutes)
	Explore the possibility of online or asynchronous methods, as it can reduce the need for synchronous in-person sessions
Untrained faculty members	Train faculty members in mentoring in microteaching and feedback delivery to equip them with the necessary skills
	Rope in senior residents to serve as microteaching mentors, reducing the faculty burden
	Refer to online tutorials or invite guest educators to conduct microteaching mentorship remotely

Resistance by residents	Sensitize residents about the benefits of microteaching and how it will help them in their future career
	Begin such sessions in low-stakes sessions, with priority on positive feedback and thereby create a supportive atmosphere
	Encourage residents to self-assess their teaching and received feedback to make the process more rewarding and less stressful
Concerns with assessment and evaluation	Frame rubrics with clear criteria regarding core teaching skills to make evaluations fair
	Use a combination of peer feedback in conjunction with faculty feedback to make the process complete
	Encourage residents to self-assess their teaching and match the same with feedback received from peers and teachers
Administrative and resource constraints	Convince administrators about the benefits of microteaching and how it can help the institution in meeting their vision, including accreditation standards
	Use existing facilities flexibly to organize such sessions without much trouble
	Use mobile phones for recording or simple platforms like Zoom or Google Meet for remote sessions, provided infrastructure, internet stability, patient privacy, and data protection are taken care of

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Original Article

The Establishment and Academic Development of the Faculty of Medicine at Kasetsart University: Advancing Medical Education and Healthcare in Thailand

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Abstract

Background: The Faculty of Medicine at Kasetsart University, as a new medical school, faces the challenge of attracting high-caliber students. This study examines the motivations of rural high school students to pursue medical education at this institution.

Objectives: To explore the key factors influencing rural high school students' decisions to study at the new medical school.

Methods: A descriptive study was conducted with 120 high school students from Sakon Nakhon province and surrounding areas in Thailand. Participants completed a structured questionnaire during the Open House event. The questionnaire assessed motivations related to academic interests, career goals, and perceptions of the medical school. Descriptive and inferential statistics were used to analyze the data.

Results: Participants were primarily aged 17 (32.5%) and 18 (40.0%), with a near-equal gender distribution (47.5% male, 52.5% female). The most important motivations for choosing this new medical school in the top three rankings were passing the medical professional licensing examination (23.33%), followed by the quality of teaching facilities (40%) and educational support technology (35%). Scholarships, welfare services, and employment opportunities were also significant motivators. Other factors, such as curriculum content, counseling processes, and research opportunities, ranked lower in importance. While there were no significant differences in the proportions of males and females ranking specific motivations as their top choice.

Conclusion: The findings suggest that rural high school students prioritize academic success, modern learning facilities, and support systems when selecting this new medical school.

Keywords: High School Students; Medical Education; Motivation

Background

Founded in 1943, Kasetsart University is one of Thailand's leading institutions, renowned for its excellence in agriculture, engineering, and science. Over the years, the university has expanded its academic programs to encompass various fields, including medical sciences. The establishment of the Faculty of Medicine represents a pivotal moment in its academic journey, underscoring its commitment to contributing to Thailand's healthcare sector (1). The faculty of medicine was created with the vision of offering high-quality medical education that is both accessible and responsive to the country's healthcare needs. Leveraging a strong foundation in science and research, the faculty provides a comprehensive medical curriculum supported by state-of-the-art facilities and cutting-edge educational technologies. This initiative reflects the institution's dedication to academic rigor, innovation, and the professional development of students. Distinguished by a multidisciplinary approach, the medical program integrates expertise from various scientific domains, enhancing the quality of education (2). The university's established reputation in other disciplines adds credibility and respect to its medical faculty, which aims to produce skilled professionals equipped to address both local and global health

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challenges. By focusing on teaching and research, the faculty is poised to shape the future of healthcare in Thailand and beyond (3).

As a new medical school, building trust, credibility, and alignment with student aspirations is crucial. Attracting high-caliber students, establishing a strong reputation, and offering competitive educational opportunities are among the key challenges (4, 5). Confidence plays a critical role in students' decisions, as they evaluate factors like facilities, academic programs, faculty expertise, and technological support (6). The medical school's respectability often stems from its perceived prestige, reputation, and alignment with societal values. While new, the university's long-standing reputation in other fields provides a solid foundation for fostering respect among students and their families (7). Today's students prioritize more than academic outcomes; they value modern technology, hands-on learning experiences, and a supportive environment (8). By addressing these expectations, the medical school can build a strong identity, attract motivated learners, and establish itself as a trusted institution in medical education (9). This article addresses the challenge of understanding how a new medical school can attract rural students in a competitive educational landscape. By analyzing motivational factors, we aim to offer insights into how institutional strategies can align with student needs in underserved regions.

Objectives

This study aimed to explore the key factors influencing rural high school students' decisions to pursue their education at a representative of new medical schools in Thailand.

Methods

Study Design: This study is a descriptive study designed to investigate the motivations of rural high school students to pursue education at the Faculty of Medicine, Kasetsart University, Thailand. Motivational features were selected based on a literature review of existing studies on medical school choice and input from subject matter experts in medical education. This ensured the relevance and comprehensiveness of factors assessed.

Participants: The participants were 120 high school students from Sakon Nakhon province and nearby areas. All participants voluntarily joined the study, and their consent was obtained before data collection. Confidentiality and anonymity of the participants were maintained throughout the study. This methodology ensured that the study was conducted systematically and ethically, providing reliable insights into the motivations of high school students.

Data Collection: Motivations were assessed using a structured questionnaire, which was distributed to participants during the open house Day event organized by the Faculty of Medicine, Kasetsart University. The questionnaire included items covering various aspects of motivation, such as academic interests, career aspirations, and perceptions of this medical school. Motivational features were selected based on a literature review of existing studies on medical school choice and input from subject matter experts in medical education. This ensured relevance and comprehensiveness of factors assessed.

Procedure: The activity was conducted in a controlled setting during the Open House event to ensure consistent administration of the questionnaire. Faculty staff and researchers provided instructions and were available to answer questions to minimize misunderstandings and ensure accurate responses. The questionnaire's reliability was evaluated by the experts using Cronbach's alpha coefficient. The result was 0.87, indicating satisfactory reliability for assessment of motivational factors.

Data Analysis: Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 26. Descriptive statistics, including frequencies and percentages, were used to summarize the participants' demographic characteristics and motivational factors. Additionally, inferential statistics such as chi-square were applied to explore differences in motivation levels based on demographic variables if applicable. The validity of the questionnaire was tested using content validity methods with feedback from experts in medical education. Specifically, the questionnaire was evaluated by three independent experts in medical education for relevance, clarity, and coverage of motivational constructs. Each item was rated using a 4-point relevance scale, and the Item-Content Validity Index (I-CVI) was calculated. All items achieved an I-CVI score of 0.80 or higher, indicating acceptable content validity. The Scale-Level Content Validity Index (S-CVI/Ave) was 0.91, which exceeds the acceptable threshold of 0.80. Reliability was evaluated using Cronbach's alpha to ensure the internal consistency of the items. The dataset included a balanced gender distribution but was not balanced across all

demographic subgroups (e.g., rural vs. urban within rural provinces). Over-prediction risks were mitigated by focusing on descriptive interpretations rather than predictive modeling. The level of statistical significance is *P* value <0.05.

Results

The demographic characteristics and motivations of the 120 participants provided valuable insights into their educational backgrounds and preferences for studying at the Faculty of Medicine, Kasetsart University (Table 1). Most participants were aged 17 (32.5%) and 18 (40.0%), representing a predominantly high school senior demographic. The gender distribution was nearly balanced, with 57 males and 63 females. In terms of educational level, the majority of participants were in Grade 12 (72.5%), followed by smaller proportions in Grade 11 (20.0%) and Grade 10 (7.50%). The students were mostly in urban areas. (78.68%).

The motivations for choosing the Faculty of Medicine at Kasetsart University were assessed and ranked by importance, as shown in Table 2. The motivations for studying medicine at this institute varied, reflecting a range of priorities among the participants (Figure 1). Passing the medical professional licensing examination emerged as the most important motivation for 23.33% of participants, although 20% ranked it as the least important factor. Facilities for teaching and learning were highly valued, with 40% of participants considering this the second most important factor, underscoring the significance of a strong academic environment. Educational support technology was ranked as a top-three priority by 35% of participants, highlighting the importance of advanced learning tools.

Data analysis compared the top-ranked motivations for studying at this medical school by gender (Analysis included only responses where each factor was selected as the first-ranked motivation by participants). The results showed no statistically significant differences between male and female students across all motivational factors, as all P-values were above the conventional significance threshold of 0.05 (Table 3).

Discussion

The findings of this study provide valuable insights into the demographic characteristics and motivations of prospective rural medical students at Kasetsart University, a new medical school.

This university can utilize these findings to design recruitment strategies such as emphasizing technological infrastructure, offering financial support, and showcasing strong licensing exam preparation, all of which align with student priorities identified in the study.

The sample consisted primarily of high school seniors, with most participants aged 17 and 18, reflecting the typical age range for students entering higher education. The gender distribution, with 57 males and 63 females, indicates a relatively balanced sample, which aligns with broader trends in medical school admissions where gender balance is gradually improving (10). The pre-university educational background of the participants, predominantly in Grade 12, suggests that the majority of students were at a critical stage in their decision-making process regarding their future academic and career paths.

The study's findings on motivations reveal a complex array of factors that influence the decision to pursue a medical degree at this new medical school. The most prominent motivation, passing the medical professional licensing examination, reflects the high value placed on professional certification and the desire to ensure a successful medical career. This finding is consistent with previous research indicating that achieving licensure is a key driver for students entering medical programs (11). However, the 20% of students who ranked the licensing exam as least important may represent a shift toward valuing educational experience, institutional environment, and career development over exam performance. This trend may reflect a broader transformation in student expectations in medical education (12). The importance of the learning environment, as indicated by the high ranking of facilities for teaching and learning, is another critical finding (13). This suggests that prospective medical students highly value the resources and infrastructure available to them, such as modern classrooms, laboratories, and access to advanced technology (14).

This emphasis on facilities supports previous studies that have highlighted the role of a conducive learning environment in shaping students' academic experiences and success in medical education (15, 16). Additionally, the significant ranking of educational support technology further underscores the growing role of digital tools and resources in contemporary medical education, as students recognize the importance of technology in enhancing learning and preparing for future clinical practice. Scholarships were ranked as a key motivator, with a substantial portion of participants placing them among the top priorities. This finding

aligns with the rising costs of education and the financial burden that many students face (17). Scholarships provide crucial financial support, allowing students to pursue their academic goals without the added stress of financial constraints. The emphasis on welfare services, including dormitory accommodation and healthcare, highlights the importance of holistic student support services. As medical programs are often demanding, students likely view a stable living environment and accessible healthcare as essential for maintaining well-being and achieving academic success (18). The relatively high ranking of employment opportunities within the medical school suggests that prospective students are thinking beyond their studies, focusing on job prospects and career advancement. This is indicative of the increasing awareness among students of the competitive nature of the medical field and their desire for job security post-graduation (19). In a similar vein, the importance of curriculum content and teaching methods demonstrates that students are not only concerned with the end result but also with the quality of education they will receive throughout their training (20). The findings related to counseling processes and opportunities for research highlight the students' interest in having access to academic and career guidance, as well as the ability to engage in research activities during their medical studies. These factors reflected the desire for a comprehensive and supportive educational experience that goes beyond just classroom learning (21). Furthermore, while postgraduate opportunities were ranked lower than other factors, their still notable importance suggests that students are thinking about their long-term academic and professional development.

While there were observable differences in the proportions of males and females ranking specific motivations as their top choice, none of the differences reached statistical significance. This suggested that gender may not play a substantial role in determining the primary motivations for students selecting the medical school. Possible explanations for non-significant differences were included in some reasons. (22, 23). 1. Sharing goals in medical education: Both male and female students may exhibit similar aspirations in medical education due to the universally high expectations associated with the profession. Factors such as passing the medical licensing examination, access to quality facilities, and robust support systems are likely essential for all students, regardless of gender. 2. Uniform exposure to opportunities: The increasing accessibility of educational resources and opportunities, such as scholarships, modern teaching technologies, and academic counseling, may contribute to a leveling of gender-based motivational differences. 3. Societal shifts: Traditional gender stereotypes regarding career choices have diminished over time, especially in fields like medicine. This shift may lead to more equal perceptions of educational priorities and motivations among male and female students. 4. Sample characteristics: The balanced gender distribution in the study sample ensures equitable representation, reducing the likelihood of bias in the data. However, it is also possible that external factors, such as regional or cultural influences, play a role in creating a homogeneity of motivations (24). Moreover, this finding highlights the importance of fostering an inclusive and equitable learning environment that caters to the collective needs of students, regardless of gender. (25, 26). While gender did not significantly influence motivational rankings, unmeasured variables such as family expectations, cultural norms, and career aspirations may still subtly shape student decisions. Future research should employ qualitative methods or longitudinal tracking to explore these dimensions.

Overall, the results of this study provide a nuanced understanding of the factors that influence prospective rural high school students' decisions to study at a new medical school. The Faculty of Medicine strategically incorporates Kasetsart University's strengths in agriculture, science, and engineering into its medical curriculum by promoting interprofessional learning, bioengineering collaborations, and public health programs focused on rural and agricultural communities. Students are not solely driven by the prospect of obtaining a degree or passing an exam but are also deeply concerned with the quality of the educational environment, financial support, career opportunities, and their overall well-being. This highlights the importance of universities continuously enhancing their academic offerings, support services, and infrastructure to meet the evolving needs of prospective students. Future research could explore how these motivations vary across different regions or countries, as well as examine the long-term impact of these motivations on students' academic success and career satisfaction. Understanding how these factors evolve throughout the course of medical education could help shape more targeted recruitment and support strategies for new medical schools.

Limitation: As data were collected during an Open House event, attendees may already have had a favorable perception of the university, potentially introducing selection bias. Future studies should include participants from broader outreach efforts to minimize this effect.

Conclusion

This study provides a comprehensive overview of the motivations driving rural high school students to pursue medical education at a new medical school. The findings reveal that key factors influencing students' decisions include the potential to pass the medical professional licensing examination, the quality of teaching facilities, and the availability of educational support technology. These factors reflect a clear preference for high academic standards, modern learning environments, and practical tools to support their education. The importance of scholarships, welfare services, and career opportunities further indicates that students value not only academic success but also financial support and overall well-being during their studies. Despite being a new medical school, Kasetsart University's ability to attract students appears to be shaped by its strong academic reputation in other disciplines, which helps establish trust and respect. This study underscores the need for the faculty of medicine to continue aligning its offerings with emerging trends in medical education, such as hands-on learning, student support services, and career advancement opportunities, in order to remain competitive with other established medical schools.

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References

1. Kasetsart University. Faculty of Medicine Overview. [cited 2025 Feb 21]. Available from: https://www.ku.ac.th.
2. Ministry of Higher Education, Science, Research, and Innovation (MHESI). Advancing Medical Education in Thailand: The Role of New Institutions. [cited 2025 Feb 21]. Available from: https://www.mhesi.go.th.
3. Faculty of Medicine, Kasetsart University. Curriculum and Academic Vision. [cited 2025 Sep 21]. Available from: https://med.ku.ac.th.
4. Montgomery RV. Diversity in Medical Schools: A Much-Needed New Beginning. JAMA. 2021 Jan 5;325(1): 23-24. doi: 10.1001/jama.2020.21576. [PMID: 33399846]
5. Hays R. Establishing a new medical school: A contemporary approach to personalizing medical education. Med Teach. 2018 Oct;40(10):990-995. doi: 10.1080/0142159X.2018.1487048. [PMID: 30422033]
6. Ricketts C, Bligh J. Developing a "frequent look and rapid remediation" assessment system for a new medical school. Acad Med. 2011 Jan;86(1):67-71. doi: 10.1097/ACM.0b013e3181ff9ca3. [PMID: 21099391]
7. Zhang D, Li G, Mu L, Thapa J, Li Y, Chen Z, et al. Trends in Medical School Application and Matriculation Rates Across the United States From 2001 to 2015: Implications for Health Disparities. Acad Med. 2021 Jun 1;96(6):885-893. doi: 10.1097/ACM.0000000000004033. [PMID: 33656008] [PMCID: PMC8630772]
8. Whalen D, Harris C, Harty C, Greene A, Faour E, Thomsonet K, et al. Should I apply to medical school? High school students and barriers to application. Can J Rural Med. 2016 Spring;21(2):46-50. [PMID: 26986684]
9. bin Abdulrahman K, Almutairi AA, Alrumaih IA, Khalid FA, Alkharashi AA, Alsaadi YM. Factors influencing high school students' decisions in applying to medical school. Middle East Journal of Family Medicine. 2023; 21(1): 267-76. doi: 10.5742/MEWFM.2023.95251592.
10. Fowler B, Brown C, Cathcart-Rake W. Medical School Campus Choice: Factors Influencing a Student's Decision to Attend a Rural Regional Medical Campus. Journal of Regional Medical Campuses. 2021: 4 (2): 22-31. doi:10.24926/jrmc.v4i2.3695.
11. Hays R. Admission to new medical schools. Med Teach. 2007 Nov;29(9):996-7. [PMID: 18167646]
12. Wouters A. Effects of medical school selection on student motivation: a PhD thesis report. Perspect Med Educ. 2018 Feb;7(1):54-57. doi: 10.1007/s40037-017-0398-1. [PMID: 29256053] [PMCID: PMC5807264]
13. Wouters A, Croiset G, Galindo-Garre F, A Kusurkar R. Motivation of medical students: selection by motivation or motivation by selection. BMC Med Educ. 2016 Jan 29:16:37. doi: 10.1186/s12909-016-0560-1. [PMID: 26825381] [PMCID: PMC4731894]
14. Wouters A, Croiset G, Schripsema NR, Cohen-Schotanus J, Spaai GWG, Hulsman RL, et al. A multi-site study on medical school selection, performance, motivation, and engagement. Adv Health Sci Educ Theory Pract. 2017 May;22(2):447-462. doi: 10.1007/s10459-016-9745-y. [PMID: 28054158]
15. Merckelbach S. Selection for medical school fairer than lottery? Not at all. Ned Tijdschr Geneeskd. 2018 Aug 1:162:D2500. [PMID: 30209902]
16. Foster K. Medical school choice: what influences applicants? Clin Teach. 2014 Jul;11(4):307-10. doi: 10.1111/tct.12146. [PMID: 24917102]
17. Miah S, Pang KH, Rebello W, Rubakumar Z, Fung V, Venugopal S, et al. What factors influence UK medical students' choice of foundation school? Adv Med Educ Pract. 2017 Apr 20:8:293-297. doi: 10.2147/AMEP.S134081. [PMID: 28458589] [PMCID: PMC5404492]

18. Sandars J, Gaunt A. Student perceptions of the influence of visual imagery in medical school application prospectuses in the UK. Med Teach. 2009 Dec;31(12):1098. [PMID: 20050108]
19. Vrdoljak L, Mijacika T, Milicevic T, Sapunar D, Puljak L. Impact of a recruitment campaign on students applications to medical school. Acta Med Acad. 2013;42(1):32-40. doi: 10.5644/ama2006-124.68. [PMID: 23735064]
20. Puljak L, Brnjas KJ, Barac LV, Sapunar D. Demographics and motives of medical school applicants in Croatia. Med Teach. 2007 Oct;29(8):e227-34. doi: 10.1080/01421590701551714. [PMID: 18236266]
21. Adams T, Garden A. What influences medical school choice? Med Teach. 2006 Feb;28(1):83-5. doi: 10.1080/01421590500313027. [PMID: 16627331]
22. Zhang K, Xierali I, Castillo-Page L, Nivet M, Conrad SS. Students' top factors in selecting medical schools. Acad Med. 2015 May;90(5):693. doi: 10.1097/ACM.0000000000000537. [PMID: 25406605]
23. Snyder A, Xiang D, Smith A, Esswein S, Toubat O, Di Capua J, et al. Gender disparities among medical students choosing to pursue careers in medical research: a secondary cross-sectional cohort analysis. BMC Med Educ. 2021 Nov 25;21(1):591. doi: 10.1186/s12909-021-03004-z. [PMID: 34823508] [PMCID: PMC8620216]
24. Asgari MM, Carr PL, Bates CK. Closing the Gender Wage Gap and Achieving Professional Equity in Medicine. JAMA. 2019 May 7;321(17):1665-1666. doi: 10.1001/jama.2019.4168. [PMID: 30951141]
25. Rowell TR, Redd RA, Neuberg DS, Walensky LD. Mind the gap: Expediting gender parity in MD-PhD admissions. JCI Insight. 2020 Feb 27;5(4):e136037. doi: 10.1172/jci.insight.136037. [PMID: 32102982] [PMCID: PMC7101133]
26. Martinez-Strengel A, Samuels EA, Cross J, D Cramer L, Desai MM, Gotian R, et al. Trends in U.S. MD-PhD Program Matriculant Diversity by Sex and Race/Ethnicity. Acad Med. 2022 Sep 1;97(9):1346-1350. doi: 10.1097/ACM.0000000000004747. [PMID: 35583935] [PMCID: PMC9474393]

Table 1. Features of high school students' demographics

Parameter	N=120	%
Ages (years)		
15	9	7.50
16	24	20.00
17	39	32.50
18	48	40.00
Gender		
Male	57	47.50
Female	63	52.50
Class level		
Grade 10	9	7.50
Grade 11	24	20.00
Grade 12	87	72.50
Residence		
Urban area	96	78.68
Outlying district area	26	21.32

Table 2. Motivational topics that were chosen for ranking

No.	Motivation factors	Selection for ranking (%)									
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
1	Passing medical professional licensing examination	23.33	13.33	1.67	6.67	15.00	1.67	3.33	10.00	5.00	20.00
2	Facilities for teaching and learning	1.67	40.00	6.67	10.00	5.00	8.33	5.00	5.00	15.00	3.33
3	Educational support technology	3.33	1.67	35.00	11.67	8.33	8.33	11.67	8.33	3.33	8.33
4	Scholarships	10.00	8.33	10.00	28.33	5.00	5.00	15.00	3.33	8.33	6.67
5	Welfare (dormitory accommodation, healthcare services)	15.00	6.67	5.00	6.67	31.67	11.67	5.00	11.67	5.00	1.67
6	Employment opportunities at the University	11.67	1.67	5.00	3.33	8.33	36.67	8.33	10.00	10.00	5.00
7	Curriculum content and teaching methods	8.33	6.67	6.67	11.67	6.67	6.67	35.00	5.00	10.00	3.33
8	Effective counseling processes for students	5.00	3.33	18.33	3.33	13.33	6.67	8.33	33.33	5.00	3.33
9	Opportunities for research work	6.67	10.00	6.67	11.67	5.00	10.00	1.67	6.67	31.67	10.00
10	Opportunities for postgraduate studies	15.00	8.33	5.00	6.67	1.67	5.00	6.67	6.67	6.67	38.33

Table 3. Gender-specific comparison of the top-ranked motivations

No.	Motivational factors	Gender		P-value
		Male (%)	Female (%)	
1	Passing medical professional licensing examination	35.7	64.3	0.15378
2	Facilities for teaching and learning	50.0	50.0	0.94308
3	Educational support technology	75.0	25.0	0.26262
4	Scholarships	58.3	41.7	0.42827
5	Welfare (dormitory accommodation, healthcare services)	33.3	66.7	0.19173
6	Employment opportunities at the university	75.0	25.0	0.71128
7	Curriculum content and teaching methods	50.0	50.0	0.86866
8	Effective counseling processes for students	66.7	33.3	0.33476
9	Opportunities for research work	60.0	40.0	0.55769
10	Opportunities for postgraduate studies	55.5	44.5	0.45788

Chi-square test for statistical significance ($P<0.05$)

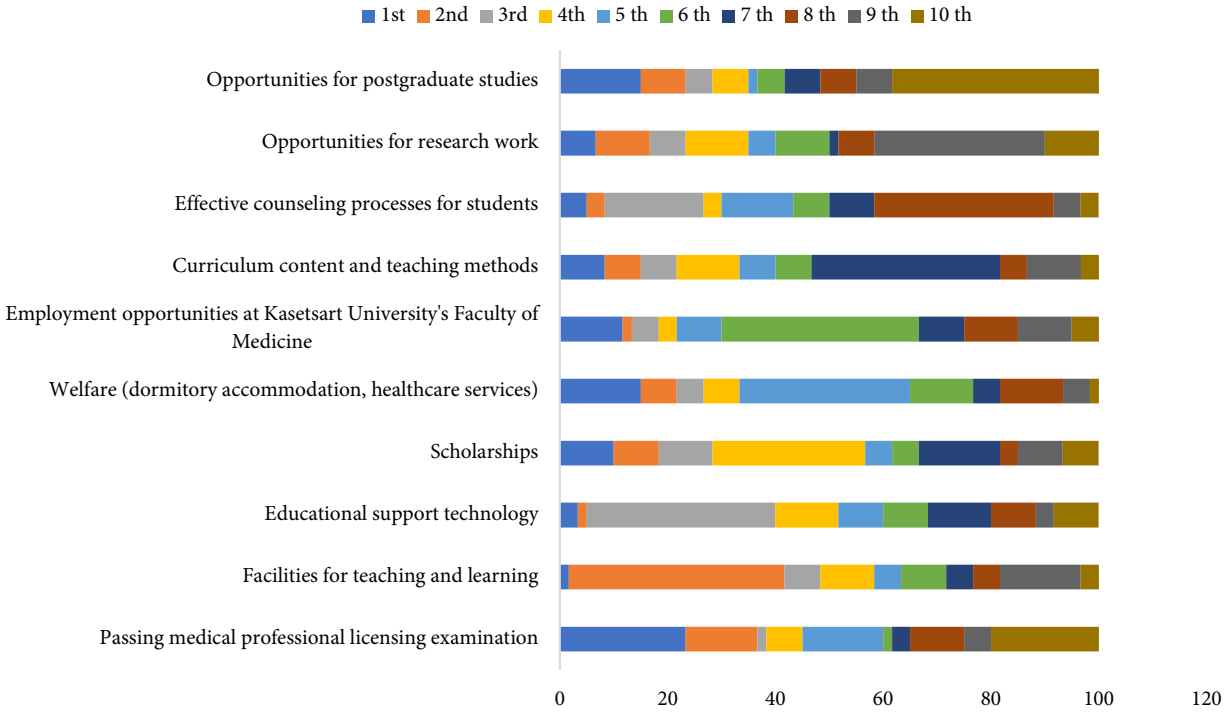

Figure 1. Comparative motivational rating chart categorized by topic

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Original Article

A new Instrument for Assessing Service Quality in E-Learning Centers (SQELC)

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Abstract

Background: Students' views play an important role in improving the quality of university services. They determine the degree of discrepancy between the status quo and students' expectations, providing the basis for improving educational service quality.

Objectives: This study aimed to design and evaluate the psychometric properties of a tool for assessing the quality of educational services in e-learning centers, based on the SERVQUAL model.

Methods: In the first step of this descriptive-analytical study, we searched for the instruments and factors affecting service quality in higher education in the literature and compiled them. Then, similar questions were merged, and all questions were rewritten, asking for experts' opinions on e-learning centers. In addition, some questions were added or removed based on expert opinions and the objective. The content validity ratio and content validity index also determine content validity. In addition, a sample of 110 students participated in the study to examine the construct validity and reliability of the instrument.

Results: In the first stage, 88 questions were extracted from related studies. After omitting similar questions, 56 questions remained. These questions were modified for the e-learning environment to make them compatible with this system. Out of the 56 items assessed for CVI and CVR, 20 were ultimately approved with a test-retest reliability of 0.769 and an internal consistency of 0.824 to evaluate the quality of educational services in e-learning centers. This tool explained 67.2% of the total variance.

Conclusion: The present research showed that the developed tool has acceptable validity and reliability and can be used to assess the quality of educational services in e-learning centers from students' viewpoints.

Keywords: SERVQUAL; Elearning; Service Quality; Student Expectation; Education, Medical; Students

Background

In every society, many organizations and institutions provide various services to people from different walks of life. Among these organizations, educational services delivered by universities not only play an important role in students' lives but also affect all parts of society (1). Universities and higher education institutions are considered the main centers of thought and science production in every society and play a significant role in the presence and activity of thinkers, scholars, and students in the community (2). Universities maximize productivity and efficient use of opportunities in the country through careful planning for educational, research, and human resources development. Besides, they improve the education quality following national and international scientific and educational developments (3).

The quality of services is one of the factors contributing to the success and sustainability of any organization, including the higher education system. Its

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sustainable development requires simultaneous and balanced growth of quantitative dimensions. Quality in Higher Education is a multidimensional concept influenced by several criteria, including the educational status, academic system, curricula, institutional conditions, and standards of the academic discipline (4). Since service satisfaction is the distinguishing element among organizations in the competitive market, student satisfaction is a determining factor in evaluating the quality of services provided by higher education organizations (5). Improving the quality of education and research, alongside providing specialized educational services, are the ultimate goals of any educational system. Hence, failing to achieve these goals results in wasting economic resources and reducing self-esteem and instability in the students' personal and social temperament (6).

Meanwhile, Information and Communication Technology (ICT) provides the opportunity to combine the art and the science of teaching and education to create an approach called e-learning (7). E-learning has ascertained many educational goals, including synchronous learning, cooperative learning, self-assessment, and self-direction. Today, e-learning in higher education is at a rapid development stage; however, it encounters problems like increasing demand for services and competition among educational centers. Hence, it is essential to improve its efficiency by adopting appropriate solutions based on evaluation evidence (8).

E-learning is an online system that facilitates teaching and learning with the advent of various web-based software tools and applications. This modern educational approach incorporates asynchronous and synchronous tools to support learning processes. E-learning enhances knowledge acquisition, clinical skill development, and learner satisfaction across various domains in medical education (9-11).

Program evaluation reveals the existing and desired status and the strengths, weaknesses, opportunities, and obstacles of e-learning systems. Students play a vital role in enhancing the quality of service and evaluating educational systems as they are the main clientele and recipients of system services. Moreover, their perspectives are the key indicator of a university's overall quality (7, 12).

One method used to evaluate the quality of universities' services is the SERVQUAL model developed by Parasuraman (13). This tool measures students' perceptions in five different dimensions of service delivery including; tangibility (facilities, equipment, staff, faculty members, and communication channels), reliability (responsibility to do services reliably), responsiveness (tendency to cooperate and assist students), assurance (competence and ability of staff and faculty members to create a sense of trust and confidence among students), and empathy (special treatment to every single student regarding their moods to convince them to realize that university system can understand them) (14). This tool examines service quality by comparing students' expectations and perceptions in each dimension. Parasuraman et al define the quality of service as the difference between clients' expectations and perceptions of services, known as the expectations-perception gap. This definition is represented by the equation (Quality = Perception-Expectation). Clients' expectations are their beliefs about the provided services that work as reference points when evaluating the services. The purpose of the customer's perception is to find out how one evaluates the service received, i.e., the customer's judgment of the service. Therefore, perceived quality is a form of insight related to satisfaction and results of comparison between expectations and perceptions of performance (8). A negative score of the gap indicates that perception is lower than expectations, and students are not satisfied with the services. On the other hand, a positive score shows that the provided services are better than expectations (14).

Nowadays, the Internet has diminished the necessity of physical presence on university campuses in many instances. Consequently, governments are encouraging the adoption of e-learning solutions. Hence, the number of higher education institutes implementing strategies and policies for integrating e-learning technology into their educational processes is increasing. Therefore, ensuring the quality of e-services from different viewpoints, including students, is necessary to provide effective e-learning systems (15, 16).

Despite the evaluations made at different universities based on the SERVQUAL model, we did not find any research examining the quality gap of e-learning services (17). There are different dimensions across different service industries and even within the same service industry. Moreover, their customers are heterogeneous. So, a customized SERVQUAL model for specific contexts is beneficial (18). Hence, regarding the importance of educational service quality, the need for high-quality online educational services, and the essence of developing a customized SERVQUAL tool, this study aimed to develop a valid and reliable tool for evaluating the quality of educational services in e-learning centers.

Objectives

This study aimed to design and evaluate the psychometric properties of a tool for assessing the quality of educational services in e-learning centers, based on the SERVQUAL model.

Methods

This descriptive-analytical study started with a review of the literature on the quality of educational services based on the SERVQUAL model and gathered the questionnaires and factors affecting service quality in higher education. Then, we compiled all the questionnaires' items, reviewed them carefully, and omitted or merged similar items. We conducted the psychometric assessment methodology for this draft of the questionnaire to ensure its validity and reliability.

Instrument development: In the first stage of this research, 12 studies addressing the questionnaires and factors regarding the quality of educational services based on the SERVQUAL model were collected (1, 3, 5, 6, 13, 14, 17, 19-23). Then, their items were collected and indexed. 88 questions were extracted from these studies. After omitting similar or irrelevant questions, 56 questions remained. An expert panel modified the items to make them compatible with an e-learning environment. The experts consisted of four e-learning and educational specialists and five university teachers with more than three years of experience in e-teaching. Modification of the questions was performed in two rounds of the expert panel.

In the next step, the face validity of the instrument was assessed by other experts, including five faculty members with higher education/e-learning expertise or with at least 3 years of e-teaching experience, and also seven junior and senior e-students. To assess the content validity, Content Validity Ratio (CVR) and Content Validity Index (CVI) were applied

To determine the CVR, experts evaluated each item on a three-part scale of "necessary", "useful but not necessary," and "not necessary". According to Lawshe, C. H. (1975) formula, if the calculated value for each question was greater than 0.57, the content validity of that question was then accepted. The Waltz & Bausell method was also applied to determine the CVI (24). For each question, three items of relevance (not relevant, relatively relevant, relevant, and completely relevant), simplicity (not simple, relatively simple, simple, and quite simple), and clarity (not clear, relatively clear, clear, and very clear) were questioned. The scores for the options of "completely relevant" and "relevant", " simple " and " quite simple "," clear " and " very clear" were added up together. Then the overall scores were divided by the number of experts. If the calculated value for each question was higher than 0.79, it was considered acceptable. The final instrument consisted of 20 pairs of questions in two parts to measure students' expectations and perceptions of the quality of educational services. The instrument items were based on a five-point Likert scale, i.e., "quite important", "important", "relatively important", "less important" and "the least important" for the expectations section; and "very good", "good", "average", "poor" and "very poor" in the perceptions section. It should be noted that each item was scored between 1 and 5. The tool was named Service Quality in E-Learning Centers (SQELC).

Exploratory Factor Analysis was also administered to examine the construct validity (25).

To assess the reliability of the tool, the test-retest approach was applied, and Cronbach's alpha was used to evaluate its internal consistency.

Study population and sampling strategy: The statistical population was students of the Tehran University of Medical Sciences (TUMS) who studied in virtual post-graduate programs. All majors and courses in these programs were delivered through virtual and blended approaches.

The required sample size for assessing reliability through test-retest was 20 participants, while the recommended sample size for evaluating construct validity ranges from 100 to 200 participants. Therefore, all eligible students were included in the study using a census sampling method. There are several methods to determine the adequacy of the sample size for factor analysis; however, the most widely accepted and reliable approach is the calculation of the Kaiser-Meyer-Olkin (KMO) index. A KMO value greater than 0.7 indicates sufficient sample adequacy to conduct factor analysis (26, 27).

All analyses were performed in IBM SPSS Statistics for Windows, version 17 (IBM Corp., Armonk, N.Y., USA).

Results

Content Validity: Out of the 56 items assessed for CVI and CVR, 20 items were ultimately approved (Table 1).

Construct Validity: The questionnaire was delivered to 110 students of virtual programs at TUMS to conduct Exploratory Factor Analysis (EFA). 72 out of 110 students (47 women and 25 men) filled the questionnaire (response rate: 65.5%). The descriptive statistics and characteristics of the participants are presented in Table 2.

Kaiser Mayer Olkin Index (KMO) at EFA was 0.773, indicating a sufficient sample size. Bartlett's Test of Sphericity (chi-square = 695.89, P < 0.001) also showed the suitability of samples for factor analysis. Five factors were extracted according to the design background, and the Varimax rotation method was applied to determine the items of each factor. In addition, coefficients less than 0.45 were omitted. According to the results, these five factors explained 67.17% of the variance, which is an acceptable value (Table 3).

The scatter plot (Figure 1) also confirms the suitability of the 5-factor solution.

Table 4 shows the rotating factor matrix. Although it is recommended that factors consist of at least three items to ensure internal consistency and stability, there are instances in the literature for retaining two-item factors when they demonstrate strong conceptual coherence and satisfactory factor loadings (26). In our analysis, both items within Factor 5 loaded exclusively on this factor, suggesting a distinct underlying construct. Furthermore, the content of these items reflects a specific, meaningful domain within the broader construct being measured.

According to the results of factor analysis and research background, the same names of factors of the original questionnaires were chosen.

The names and questions of the factors and the internal consistency of each factor are presented in Table 5.

Reliability: The reliability of the instrument was examined through the test-retest method. Reliability in a 20-person sample after two weeks of replication, using the Interclass Correlation Coefficient (ICC), was 0.769. Cronbach's alpha for all items also showed 0.824 internal consistency for the whole instrument. The results of the questionnaire analysis among participants are presented in Table 6.

Discussion

This study aimed to design a service quality assessment instrument for e-learning centers based on the SERVQUAL model and evaluate its psychometric properties. The final tool for evaluating service quality in e-learning centers consisted of 20 items and five extracted factors named the same as the main SERVQUAL model.

E-learning is an instructional strategy to enhance teaching-learning processes through web-based systems, software tools, and applications (28). Specifications of e-learning, such as being student-centered and self-directed, and its capabilities for deploying different types of interaction, have made it a persistent and effective approach in which a wide range of asynchronous and synchronous tools are used (29, 30). Differences between e-learning and face-to-face instruction show that the dimensions and factors affecting their quality are different. E-learning aspects can be divided into system design, system delivery, and system outcome, which should be considered to measure their quality (22).

Positive attitude towards students and realizing their needs, providing effective feedback, and appropriate facilities such as appropriate hardware and software, guidelines, and actively announcing them are the main parts of the factor "responsiveness". The factor "assurance" consists of the appropriate delivery of assignments, curriculum, and e-content through media such as learning management systems. Providing sufficient and timely resources, assignments, communication facilities like discussion groups, experienced instructors, and access to reliable internet are composed of the factors of "Reliability". Sense of trust for students, preparing an expedient environment, and respectful behavior of managers are considered as "Empathy". Finally, inspiring students' creativity and considering their achievements, and preparing a feedback system for improving the quality of services are classified as "tangibility".

Sugant determined four dimensions for e-learning services to be evaluated as service quality: Content (design and presentation, structure, completeness), usability (attractive interface, ease of navigation, interactivity, progress tracking), technology (fast, reliable, support), and responsiveness (assessment and evaluation) (31).

In SQELC, items 2, 5, 9, 11, and 12 cover components of the dimension "content"; items 1, 13, 14, and 16 cover components of the dimension "usability"; items 18 and 20 are related to "technology " and items 3, 15, and 16 are according to the dimension "responsiveness".

Ayuni and Mulyana (32) assessed the relationship between service quality and satisfaction, and loyalty of the students in the e-learning system. They used four dimensions for e-learning service quality, consisting of teaching dimension, administrative services, support services, and system, which have been developed previously (33). Items 5, 7, 10, and 17 are according to administrative services, items 2, 9, 11, 12, 13, and 15 are according to teaching dimension, items 3, 6, 7, 8, 10, 17, 18, and 19 are compatible with support services, and finally, the dimension of "system" can be evaluated

through items 14, 16, 17, 18, and 20. It is visible that some items overlap between different dimensions.

The results of SQELC can lead to the analysis of deficiencies in e-learning centers. It also provides conductive solutions to reduce the observed quality gaps in educational services. The results obtained from the Virtual School of TUMS showed that perceptions and expectations were close in all aspects of the quality of educational services, including accountability, reliability, assurance, and empathy. Although this gap was negative in all dimensions, in other words, students' expectations were beyond their perceptions of the actual status quo; the difference was not significant in terms of effect size (gap size), while its statistical significance may be because of the high sample size. The existence of a quality gap in the dimension of accountability can indicate students' dissatisfaction regarding unclear announcements of the school or even its inadequacy in terms of providing feedback on students' assignments in the virtual setting. This illustrates the need for instructors and professors to engage with students and provide feedback on their homework. The style and type of implementation of e-courses, where students have less access to teachers and where traditional classes are not available, doubles the importance of providing feedback on students' homework. Quality of service in terms of reliability means the ability to perform the service reliably and or act with commitment. The service gap in this dimension can reflect students' dissatisfaction with the quality of the Internet and how they interact in the LMS environment, such as the expected time for students to deliver homework, the provision of tutorials, and even facilitating discussions in the virtual classroom by instructors. The dimension of assurance in SQELC indicates the competence and ability of university staff and faculty members to induce a sense of trust. The negative gap in performed services in this dimension indicates that, from the student's point of view, assignments are not appropriate and lesson-related, and the school has failed to provide confidence among students to make them feel safe and secure. The tangible and physical dimension means that the conditions and environment of the setting are available to provide services, including facilities, equipment, staff, and communication channels.

In addition, the empathy (the factor 4 with three items) means a personalized attitude toward one's mood. In this case, it means that students believe that the university staff perceive each individual of them. Proper behavior and respectful treatment towards students can bring students' expectations up to the level of their perception in this dimension. The negative gap in service quality in the empathy dimension indicates that students do not have appropriate mechanisms to express their views and suggestions.

Limitations: One limitation of this study is that it focuses solely on one university. It is recommended that the SQELC results be evaluated across multiple medical universities to better understand the accuracy of its results. Additionally, the available sample size was not satisfactory. Although the statistical indices showed their adequacy, it is recommended to apply the tool to a large population. Furthermore, investigating the optimal results for different academic fields would be valuable.

Conclusion

In this study, SQELC, an instrument of service quality assessment for e-learning centers, was devised. This instrument uses student feedback to evaluate service quality. It is suggested that other stakeholders, such as teachers and staff, also be considered in plans. The results obtained in evaluating the quality of services in e-learning centers are considered as guidelines for management, instructors, and staff to be informed of the strengths and weaknesses of the services so that they can improve the quality of educational services by removing the weaknesses as well as improving the strengths.

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References

1. Goumairi O, Aoula ESĆ, Ben Souda S. Application of the SERVQUAL Model for the Evaluation of the Service Quality in Moroccan Higher Education: Public Engineering School as a Case Study. International Journal of Higher Education. 2020;9(5): 223-9. doi:10.5430/ijhe.v9n5p223.
2. Rezaiyan MK, Bazaz SMM. Quality Gap in educational services based on SERVQUAL Model in Mashhad Medical School. Research on Medicine. 2016;40(1):17-23. [In Persian]
3. Ko CH, Chou CM. Apply the SERVQUAL instrument to measure service quality for the adaptation of ICT technologies: A case

study of nursing homes in Taiwan. Healthcare (Basel). 2020 Apr 24;8(2):108. doi: 10.3390/healthcare8020108. [PMID: 32344589] [PMCID: PMC7349199]

4. Martínez-Argüelles M, Castán J, Juan A. How do Students Measure Service Quality in e-Learning? A Case Study Regarding an Internet-Based University. Electronic Journal of e-Learning. 2010; 8(2): 151 -60.
5. Aghamirzaee Mahali T, Babazadeh M, Rahimpour kami B, Salehi Omran A. Assessment and Ranking of Educational (Administrative) Services Quality from Students Opinion (A case Study on Mazandaran University of Science and Technology). Educ Strategy Med Sci 2017; 10 (4): 288-301. [In Persian]
6. Gilavand A, Maraghi E. Assessing the quality of educational services of Iranian universities of medical sciences based on the SERVQUAL evaluation model: A systematic review and meta-analysis. Iran J Med Sci. 2019 Jul;44(4):273-284. doi: 10.30476/IJMS.2019.44946. [PMID: 31439970] [PMCID: PMC6661524]
7. Li CY, Asimiran S, Suyitno S. Students' expectations and perceptions on service quality of e-learning in a selected faculty of a public university in Malaysia. Proceedings of the 3rd International Conference on Educational Management and Administration; 2018 Oct 6-7; Malang, Indonesia. 2018: 85-90.
8. Samir Roushdy A, El-Ansary O. Measuring Students' Perception of E-SERVQUAL at E-learning Institutions: Evidence from Egypt. Scientific Journal for Economic& Commerce. 2017;1;47(2): 583-614. doi:10.21608/jsec.2017.40514.
9. Mojtahedzadeh R, Mousavi A, Shirazi M, Mohammadi A. Factors creating an educational atmosphere in cyberspace: a qualitative study. Strides Dev Med Educ. 2017 May 1;14(2): e66898.
10. Mousavi A, Mohammadi A, Mojtahedzadeh R, Shirazi M, Rashidi H. E-Learning Educational Atmosphere Measure (EEAM): A New Instrument for Assessing E-Students' Perception of Educational Environment. Research in Learning Technology. 2020;28: 1-12. doi:10.25304/rlt.v28.2308.
11. Liu Q, Peng W, Zhang F, Hu R, Li Y, Yan W. The Effectiveness of Blended Learning in Health Professions: Systematic Review and Meta-Analysis. J Med Internet Res. 2016 Jan 4;18(1): e2. doi: 10.2196/jmir.4807. [PMID: 26729058] [PMCID: PMC4717286]
12. Handrinos MC, Folinas D, Rotsios K. Using the SERVQUAL model to evaluate the quality of services for a farm school store. Journal of Marketing and Consumer Behaviour in Emerging Markets. 2015; 1 (1): 62-74. doi: 10.7172/2449-6634.jmcbem.2015.1.5.
13. Đonlagić S, Fazlić S. Quality assessment in higher education using the SERVQUALQ model. Management: Journal of Contemporary Management Issues. 2015;20(1):39-57.
14. Berry LL. SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing. 1988;64(1):12-40.
15. Ithnin F, Sahib S, Eng CK, Sidek S, Harun RN. Mapping the Futures of Malaysian Higher Education: A Meta-Analysis of Futures Studies in the Malaysian Higher Education Scenario. Journal of Futures Studies. 2018 Mar 1;22(3): 1-18. doi:10.6531/JFS.2018.22(3).00A1.
16. Mohammadi A, Norouzadeh R, Hosseini SE, Mohammadi M, Tahrekhani M. Investigating the Effectiveness of Online Learning in the Post-Coronavirus (COVID-19) Era from the Perspectives of Students and Faculty Members of Selected Universities of Medical Sciences in Iran. Strides Dev Med Educ. 2025; 22(1): e1447. doi: 10.22062/sdme.2025.200378.1447.
17. Uppal MA, Ali S, Gulliver SR. Factors determining e-learning service quality. British Journal of Educational Technology. 2018;49(3):412-26. doi: 10.1111/bjet.12552.
18. Park SJ, Yi Y, Lee YR. Heterogeneous dimensions of SERVQUAL. Total Quality Management & Business Excellence. 2021;32(1-2): 92-118. doi:10.1080/14783363.2018.1531700.
19. Hinkin TR. A review of scale development practices in the study of organizations. Journal of management. 1995;21(5):967-88. doi: 10.1177/014920639502100509.
20. Hosseini SM, Vakili V, Mosa Farkhani E. Comparing pharmacy students' perceptions and expectations of quality of educational services at Mashhad University of medical sciences based on SERVQUAL model. Iran J Med Educ. 2017;17: 504-15. [In Persian]
21. Buditjahjanto IG. Customer Satisfaction Analysis Based on SERVQUAL Method to Determine Service Level of Academic Information Systems on Higher Education. Khazanah Informatika: Jurnal Ilmu Komputer dan Informatika. 2020;6(2): 103-8. doi: 10.23917/khif.v6i2.10690.
22. Abd Rahman NA. E-learning service quality case study: Al Madinah International University. (dissertation). Malaysia: Universiti Teknologi MARA (UiTM); 2017.
23. Al-Mushasha NF, Nassuora AB. Factors determining e-learning service quality in Jordanian higher education environment. Journal of Applied Sciences (Faisalabad). 2012;12(14):1474-80.
24. Lawshe CH. A quantitative approach to content validity. Personnel Psychology. 1975; 28(4): 563-75. doi:10.1111/j.1744-6570.1975.tb01393.x.
25. Raj GM, Adhimoolam M. A Novel Questionnaire to Assess the Knowledge, Attitude, and Practice of Medical Professionals Regarding Participation in Scientific Programs. Strides Dev Med Educ. 2024;21(1):156-65. doi:10.22062/sdme.2024.199185.1305.
26. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate data analysis. 8th ed. Boston: Cengage; 2019: 136.
27. Shokoohi S, Emami AH, Mohammadi A, Ahmadi S, Mojtahedzadeh R. Psychometric properties of the Postgraduate Hospital Educational Environment Measure in an Iranian hospital setting. Med Educ Online. 2014 Aug 8:19:24546. doi: 10.3402/meo.v19.24546. [PMID: 25109351] [PMCID: PMC4127829]
28. Cassidy S. Virtual learning environments as mediating factors in student satisfaction with teaching and learning in higher education. Journal of Curriculum and Teaching. 2016;5(1): 113-23. doi:10.5430/jct.v5n1p113.
29. Hampel G, Dancsházy K. Creating a virtual learning environment. Journal of Agricultural Informatics. 2014;5(1): 46-55. doi:10.17700/jai.2014.5.1.124.
30. Bdiwi R, de Runz C, Faiz S, Ali-Cherif A. Smart learning environment: Teacher's role in assessing classroom attention. Research in Learning Technology. 2019;27: 1-14. doi:10.25304/rlt.v27.2072.
31. Sugant R. A framework for measuring service quality of e-learning services. Proceedings of the 3rd International Conference on Global Business, Economics, Finance and Social Sciences; 2014 Dec 19-21; Mumbai, India. 2014: 19-21.
32. Ayuni D, Mulyana A. Applying service quality model as a determinant of success in E-learning: The role of institutional support and outcome value. Review of Integrative Business and Economics Research. 2019;8:145-59.
33. Martinez-Arguelles MJ, Callejo MB, Farrero JM. Dimensions of perceived service quality in higher education virtual learning environments. International Journal of Educational Technology in Higher Education. 2013;10(1):2685.

Table 1. CVI and CVR of the approved items

Item No.	Items	CVI	CVR
1	Facilitating discussion and exchanging ideas in the LMS* and virtual classroom by instructors	1	0.70
2	Providing sufficient curriculum resources in the LMS to increase students' specialized knowledge	1	1
3	Encouraging students' creativity and considering their achievements	0.85	0.75
4	Creating a sense of trust for students to receive services and correcting staff behavior	0.85	0.85
5	Appropriate timing when providing resources and assignments to students in the LMS	1	1
6	Positive attitude of staff towards students	0.85	1
7	Providing a quiet and convenient place for studying in the center	1	0.80
8	Realizing students' needs by the staff	1	1
9	Assigning suitable assignments regarding the lessons in the LMS	1	1
10	Respectful behavior and attitude of center managers toward students	1	1
11	Providing curriculum in a systematic and interconnected manner in the LMS	1	1
12	Providing comprehensible and usable e-content for the student	1	1
13	Evaluating and providing feedback on student assignments	0.85	0.80
14	Electronic recording of students' academic profiles	0.80	0.70
15	Teachers' virtual teaching skills and experience	1	1
16	Being a feedback system to improve the quality of service of the faculty	1	1
17	Introducing and announcing the faculty services clearly	0.80	1
18	Providing a constant connection to high-speed internet	1	0.85
19	Being attractive guidelines and instructions in virtual systems	1	1
20	Providing appropriate hardware and software facilities	1	1

Table 2. Characteristics of the study participants

Categories	Value
Sex: N (%)	
Male	25 (34.7)
Female	47 (65.3)
Age: Mean (SD)	37.21 (7.60)
Degree: N (%)	
E-learning in Medical Education	38 (52.8)
Educational Technology in Medical Sciences	17 (23.6)
Medical Librarianship and Information Science	3 (4.2)
Medical Education	14 (19.4)

Table 3. Extracted components and Total Variance Explained for SQELC tool

Component	Rotation Sums of Squared Loadings	
	% of Variance	Cumulative %
1	21.852	21.852
2	12.864	34.716
3	12.647	47.362
4	11.260	58.622
5	8.544	67.166

Table 4. Factor loadings of items on extracted components after varimax rotation in exploratory factor analysis

Items	Component				
	1	2	3	4	5
1			0.692		
2			0.463		
3					0.577
4				0.736	
5			0.593		
6	0.647				
7				0.641	
8	0.659			0.478	
9		0.575			
10				0.741	
11		0.855			

12		0.834			
13	0.525	0.469			
14	0.807				
15			0.486		
16					0.779
17	0.788				
18			0.743		
19	0.760				
20	0.737				

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

Table 5. Components' names, their items, and internal consistencies

Component	Name	Items	Cronbach's alpha
1	Responsiveness	6, 8, 13, 14, 17, 19, 20	0.887
2	Assurance	9, 11, 12	0.842
3	Reliability	1, 2, 5, 15, 18	0.716
4	Empathy	4, 7, 10	0.401
5	Tangibility	3, 16	0.345

Table 6. Comparing expectations and perceptions of quality services in E-Learning Schools using SQELC

Factors	Expectations	Perception	Gap	T	P
Responsiveness	29.71	21.87	-7.84	12.940	< 0.001
Assurance	14.33	10.99	-3.35	11.873	< 0.001
Reliability	23.44	18.23	-5.22	8.532	< 0.001
Empathy	12.75	11.46	-1.29	4.373	< 0.001
Tangibility	8.96	6.30	-2.66	7.727	< 0.001

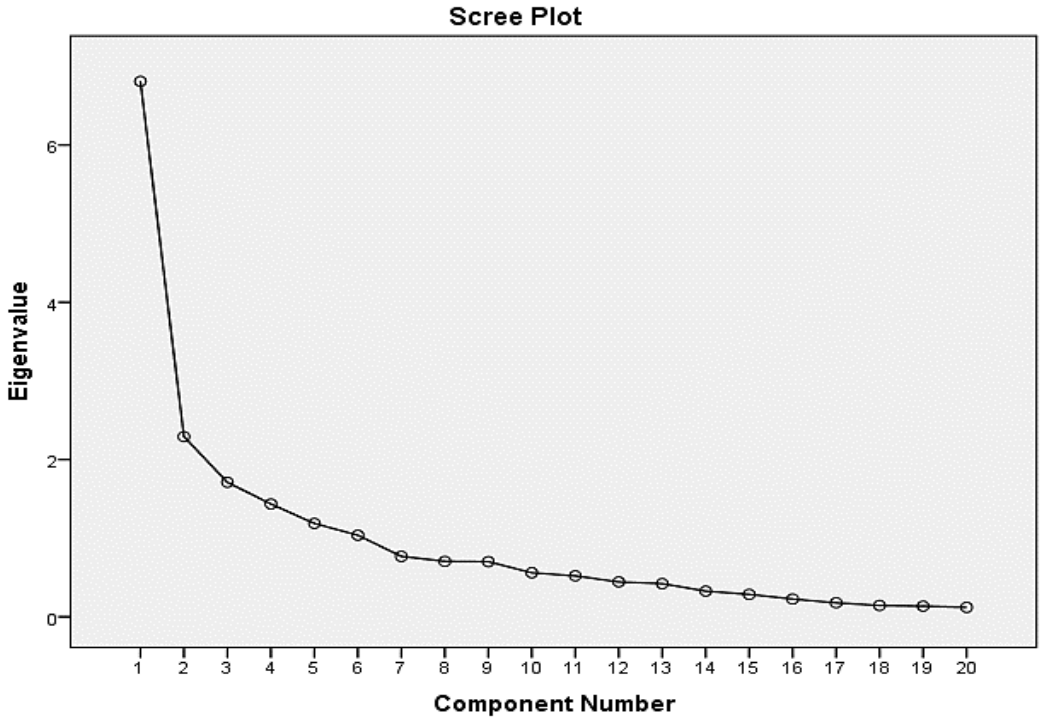

Figure 1. Scree plot

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Original Article

Assessing the Impact of Integrating the AETCOM Module on Doctor-Patient Relationship into the First Phase Medical Curriculum

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Abstract

Background: The doctor-patient relationship is an integral part of community care, which has long-term effects on patients' physical and mental well-being. "Competency-Based Undergraduate Medical Education Curriculum 2019(CBME)" has integrated a structured "Attitude, Ethics, and Communication" (AETCOM) program in the MBBS curriculum. AETCOM module 1.3 focuses on the "doctor-patient relationship" (DPR).

Objectives: The objective of this study was to know the effectiveness of implementing an AETCOM session on the DPR and to analyse the students' perceptions of the AETCOM module 1.3.

Methods: This Quasi-experimental study was carried out after obtaining institutional Ethical clearance and consent from the participants. 157 out of 250 Phase I MBBS students participated in the study. AETCOM module on the "doctor-patient relationship" was taught to the first phase MBBS students through an interactive lecture, role play and videos. Pre-tests and post-tests were conducted to find out the effectiveness of the module. The students' perception was assessed through a feedback-based 5-point Likert scale. A paired T-test was used to determine the statistical significance (p-value < 0.05 considered significant).

Results: Our study showed significantly higher post-test marks than pretest ones with a p-value <0.05. The students responded positively to the AETCOM module and ascertained that it made them aware of the patient's rights and would facilitate future interaction with patients.

Conclusion: This study emphasizes the necessity of including the "doctor-patient relationship" module as a part of the medical undergraduate curriculum, as it will prime the students regarding their roles and responsibilities toward patients and the community.

Keywords: AETCOM Module; Doctor-Patient Relationship; CBME; Empathy

Background

The doctor-patient relationship is an integral part of community care, which has long-term effects on patients' physical and mental well-being (1). This is especially important these days as there are increasing conflicts between doctors and patients (2, 3). To be a competent doctor, undergraduate medical students must learn interaction skills that will help them interact with patients on a personal level. However, for years, soft skills like attitude, ethics and communication were informally taught to medical students through the "hidden curriculum," where teachers disseminated the AETCOM lessons to the students during clinical postings and internship duty (4, 5). However, these informal teaching methods often fail to develop the required skills, increasing disharmony in the doctor-patient relationship. To tackle this issue, the "Competency-Based Undergraduate Medical Education Curriculum 2019 (CBME)" has integrated a structured "Attitude, Ethics, and Communication" (AETCOM)

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program in the MBBS curriculum. This initiative envisages equipping medical students with the knowledge and skills essential for a physician (6, 7). Under the CBME curriculum, training in soft skills has been introduced right from the beginning of the first phase of MBBS. Indian medical graduates need to possess a thorough understanding of the legal and ethical responsibilities governing the doctor-patient relationship, behavior towards patients, communication, and respect for the cadaver, and these are taught in the AETCOM classes just like teaching other medical subjects (8-10).

AETCOM module 1.3 focuses on the "doctor-patient relationship" (DPR). This module emphasizes teaching the students the role of empathy in patient encounters. Empathy in healthcare is pivotal in improving the satisfaction level of patients and achieving a good doctor-patient relationship. "The ability of a doctor to appropriately recognize a patient's emotional state and to express that understanding to the patient is known as empathy in the medical sector" (11, 12).

The CBME curriculum has been implemented since 2019, however, there is a clear research gap in assessing the effectiveness of structured AETCOM modules, especially during the First phase of medical education. The AETCOM part remains a grey area in medical education, so there are only a few studies on AETCOM in medical education. Hence, this study aimed to know the effectiveness of implementing AETCOM sessions on the "doctor-patient relationship" and to analyze and explore the students' perceptions of the AETCOM module 1.3 on the doctor-patient relationship based on the content, delivery, and relevance of the module.

Objectives

The objective of this study was to know the effectiveness of implementing an AETCOM session on the DPR and to analyses the students' perceptions of the AETCOM module 1.3.

Methods

This study was carried out in the Department of Physiology, in a medical college of Bhubaneswar, Odisha, after obtaining Institutional ethical clearance and written consent from all the participants.

Study design: Cross-sectional l study

Study participants: First year MBBS students

Inclusion criteria: All the first-phase medical students who attended the AETCOM class on the day of study and consented to participate in the study.

Exclusion criteria: The first phase medical students who did not attend the AETCOM class on the day of study.

Sample size: The calculated sample size was 154 using the formula $n= N / (1+N.e^2)$ (n = required sample size, N = population size (here, 250), e = margin of error (commonly 0.05 for 5%). However, for better representation, we included all the 157 students who attended the class that day and consented to participate in the study.

Sampling method: Convenient sampling

Study tool

Quantitative Data: MCQs were used to assess knowledge through pre- and post-tests, and a Likert Scale-based Feedback Questionnaire was used to assess the students' perceptions. The questions were prepared from recommended books on AETCOM and a thorough literature review. The content validity of the test questions was established by four subject experts in Physiology and four members of the Medical Education Unit. Using a 4-point rating system (1 being irrelevant and 4 being highly relevant), each expert independently assessed the test items' relevance, clarity, and alignment with the intended learning objectives. Each item and the test as a whole had a Content Validity Index (CVI) determined. Items were kept if their item-level CVI (I-CVI) was ≥ 0.78. Cronbach's alpha was used to evaluate the test's internal consistency. The test items' acceptable reliability was indicated by the computed alpha coefficient, which was 0.82.

Qualitative Data: Reflective writings of students on the session were used to evaluate the students' views regarding the "doctor-patient relationship".

Data collection: Data collection was done by structured MCQs and the feedback from the students during the pre and post intervention period (Figure 1).

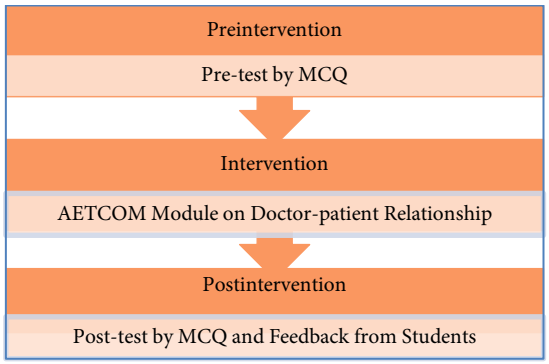

Figure 1. Stages of conducting the study and data collection

1. Preintervention: A pre-test Assessment was done by MCQs to obtain baseline data for assessing the

student's prior understanding of the AETCOM module 1.3 on the "doctor- patient relationship".

2. Intervention: Here, the students were taught about the given module in two steps:

- ***Step 1:*** The class's learning objectives were set, and the teaching schedule was designed meticulously and arranged as per the learning objectives.
- ***Step 2:*** The S.I.R technique (13) was adopted to implement the AETCOM module. S.I.R is the abbreviation for "sensitisation, immersion and reflective writing".

- Sensitization was done through an interactive lecture by the teacher.

- Immersion was done by video-based learning and role-play by students.

- Reflective writing: students were asked to write reflective on the class under the headings, "what happened, so what, and what next?" in their log books and qualitative analysis of these writings was done.

3. Post-intervention: A post-test Assessment was done by MCQs following the completion of the AETCOM module to assess change in the student's understanding regarding the module on the doctor-patient relationship.

4. Finally, a revalidated questionnaire was circulated among the students in the Google form link, and their feedback was collected.

Data analysis: The data analysis was done using SPSS software. Qualitative analysis was done by obtaining percentages in student's perception data. Paired t-test was used to compare the means for statistical significance. P value <0.05 was considered as statistically significant.

Results

A total of 157 first-phase MBBS students participated in the study. Out of the 157 participants, 69 were female and 88 were male (Figure 2).

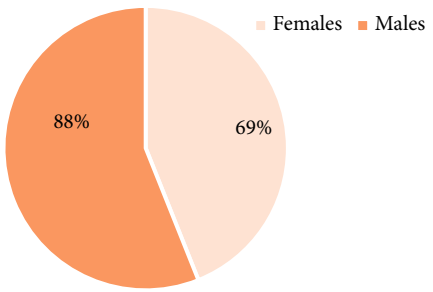

Figure 2. Distribution of study participants

The mean pre-test score was (3.20 ± 1.40) and following the implementation of the AETCOM module on the Doctor-patient relationship, the mean post-test score increased significantly to (5.32 ± 1.85). This improvement in the post-test score was statistically significant with a p-value of 0.0014 (Table 1), indicating the effectiveness of implementing the AETCOM module.

Table 1. Comparison of Mean pre-test and post-test marks of the AETCOM module on doctor-patient relationship

Tests	Mean marks obtained	Standard deviation	P value
Pre-test	3.20	1.40	0.0014*
Post-test	5.32	1.85	

*P-value significant

The students provided positive feedback regarding the AETCOM modules (Table 2). The majority of the students strongly agreed that the session on the "doctor-patient relationship" enhanced their knowledge about the DPR (66.2%), it will be helpful in future patient interactions (66.2%), it will help them gain the confidence of patients and for gaining their self-confidence (60.5%), it will help them in their practice in future and a valuable method for improving their diagnosis (57.3%), understanding and respecting patients are a good part of DPR (79%), treating all patients with equanimity is an important aspect of clinical practice (75.2%), gained insight into patient's right (59.2%), gained insight into doctor's rights (61.5%) and satisfied with module 43.9%. 67.9% of students strongly agreed that it should be included in the MBBS curriculum.

Students' reflections demonstrate profound personal commitment and ethical understanding developed through this module (Table 3).

Discussion

The "Indian Medical Graduate" (IMG) must have the desired knowledge, skills, and attitudes to effectively serve as a physician of first contact when exposed to the community. Soft skills like attitude, ethics and communication were not included in the medical curriculum and were not emphasized upon, so there were many flaws in the interaction and communication between doctors and their patients. There are growing cases of violence against doctors due to the strained relationship between them. A good interpersonal relationship between a doctor and his patient will not only help gather information and aid in accurate diagnosis of the disease but also help counsel the patients appropriately, dispense therapeutic directions, and set up caring relationships with patients.

MCI and the NMC, India, have given utmost importance to it and have introduced "Attitude Ethics and Communication (AETCOM)" in GMER-2019. Taking into account its content, including the principles of bioethics and communication skills, the teaching-learning methods have to be interactive. There are several methods recommended for the AETCOM booklet by the NMC, including role-play, case studies, focused group discussions, and peer-assisted learning, in addition to traditional methods (14). Communication remains a central place in AETCOM, which paves the way to learn and imbibe the virtues positively. With the stressful medical education curriculum, the medical students are liable to suffer from 'burnout symptoms', which is another major reason for the decrease in moral professionalism and decreased empathy scores. One of the integral parts of the health-care delivery system is the doctor-patient relationship. Therefore, we must train our students in this aspect. Soft skills like knowledge and practical experience in medical ethics are acquired through observing seniors and exposure to different clinical situations (15). This dimension was not emphasised in mainstream medical education, and a disparity existed between the knowledge acquired in theory class and the execution of the soft skills. A study by Ahsin et al. and Mueller and Roberts et al. has highlighted the importance of medical ethics and communication in the medical curriculum (16-18). De Vignemont F and Jacob P state that "empathy must be supplemented by other experiences like sympathy and care (19). Recognising this gap, the Medical Council of India introduced AETCOM modules in the training period for medical students. AETCOM modules 1.3 encompass "doctor-patient relationships (20)." However, the MCI/NMC has introduced "AETCOM modules", but its proper implementation requires to be monitored. There should be a timely evaluation of the "AETCOM modules" Moreover, as there is increased agitation in society due to a lack of empathy towards patients, our duty as medical teachers is to create awareness of the "doctor-patient relationship" among budding doctors. It is important to ignite the essence of ethics and professionalism as early as possible. As first-contact physicians, medical students must be well-equipped with the knowledge and skills to disperse their duties properly.

Teachers must be well-trained to impart the right knowledge and skills to their students, which will help in future while interacting with their patients. Empathy in the "doctor-patient relationship" can be taught through role play and videos. Students must be aware of the rights of doctors and patients and should treat patients with utmost care and empathy. During the AETCOM session, we addressed the medical students regarding the need to respect and understand patients, develop a holistic approach while treating their patients, understand patients' complaints, and try to cure the disease by an empathetic approach. Students were also given an insight into the advantages of developing a positive "doctor-patient relationship". Our study has shown significant change in the post-intervention scores, suggesting that the module effectively imparts knowledge after the AETCOM session on the "doctor-patient relationship"; students developed an increased understanding of the importance of empathy towards patients (Table 1). Analysis of the student's perception of the AETCOM module on the "doctor-patient relationship" (Table 2) and post-session reflection (Table 3) showed that most students understood the importance of the module and revealed their satisfaction with the module. Our study is similar to the findings of Bidikar et al. (21). Including AETCOM modules in the CBME curriculum to explicitly instil "attitude, ethics, and communication skills" (AETCOM) in the medical education curriculum is beneficial for igniting the importance of ethics and professionalism in the minds of medical students. Our study highlights the significant educational value and positive impact of implementation structured AETCOM module on the doctor–patient relationship (DPR) among first-phase MBBS students. The major implications of our study are, promoting empathy and ethical practice in future clinicians and enhancing clinical readiness and patient-centered care in real time scenario.

Limitations: The study included only one AETCOM module implemented in the first-year MBBS curriculum. It was not implemented in the second and final years when the students are actually exposed to the patients. Students might have given favourable feedback to align with perceived expectations, rather than reflecting their true opinions. Also, the long-term effect of the module couldn't be determined. We recommend a follow-up study to determine the long-term impact of this module and a detailed evaluation of other AETCOM modules to determine the effectiveness of implementing the AETCOM Modules. Our study is a single institutional study, to increase generalizability, multi-centric studies involving multiple medical colleges across different regions should be conducted.

Conclusion

Good "doctor-patient relation" is a fundamental aspect of the AETCOM module, which is crucial for

bridging the gap between doctors and patients and ensuring effective patient management. Our study highlights the need to implement the AETCOM module in the medical curriculum right from the first year of MBBS so that they are equipped with adequate knowledge and skills before they are actually exposed to their patients in future. The faculty members should also undergo sensitisation and training on AETCOM before they give proper training to the MBBS students. They must ensure that as Indian medical graduates, the students develop comprehensive competencies in AETCOM needed to be the "physician of first contact". We recommend that the teaching of the AETCOM modules should start from first year of medical education and should be reinforced longitudinally through all years of medical training to ensure retention and practical application. Further longitudinal studies must examine how AETCOM modules influences clinical behavior during internship and practice to assess real world effectiveness and guide ongoing improvement.

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References

1. Jotkowitz A. Medical education, managed care and the doctor-patient relationship. Am J Bioeth. 2006 Jan-Feb;6(1):46-7. doi: 10.1080/15265160500394820. [PMID: 16423792]
2. Aayog NI. A Preliminary Report of the Committee on the Reform of the Indian Medical Council Act, 1956. [cited 2016 Aug 7]. Available from: https://www.renewalskeptics.com/
3. Arneja I, Lal P. Communications skills training–a missing link in medical education curriculum. MAMC Journal of Medical Sciences. 2017 Sep 1; 3(3): 117-9. doi:10.4103/mamcjms.mamcjms_70_17.
4. Babu KR, Bhagyalakshmi A, Shanthi B. Student's Opinions of the Role Play as an Aetcom Learning Technique Among First-Year MBBS Students. Journal of Cardiovascular Disease Research. 2023; 14(1): 3483-6.
5. Vijayasree M. Perception of attitude, ethics and communication skills (AETCOM) module by first MBBS students as a learning tool in the foundation course. J Evid Based Med Healthc. 2019; 6(42): 2750-3. doi: 10.18410/jebmh/2019/571.
6. Health Sciences. Professional Development and Educational Scholarship. [cited 2024 Apr 27]. Available from: https://healthsci.queensu.ca/.
7. Chaudhuri S, Dutt R, Ahmad S. Perception of doctor-patient relationship among undergraduate medical students in a medical college of West Bengal. National Journal of Research in Community Medicine. 2019 Apr;8(2):192-5. doi:10.26727/NJRCM.2019.8.2.192-195.
8. AMA. Code of Medical Ethics. [cited 2024 Apr 27]. Available from: https://www.ama-assn.org/about/ethics.
9. Sarkhel S. Teaching communication skills to Indian Medical Graduates: Time for psychiatrists to take the leading role! Indian J Psychiatry. 2024 Jul;66(7):589-590. doi: 10.4103/indianjpsychiatry.indianjpsychiatry_583_24. [PMID: 39257503] [PMCID: PMC11382758]
10. Dutta S, Mukherjee M, Shukla V, Mishra A, Saha R, Basu SS, et al. Introduction of Module-based Training on Communication Skills among Interns in a Tertiary Care Teaching Hospital of Kolkata, India. Journal of Clinical & Diagnostic Research. 2022;16(3): JC15-JC20. doi:10.7860/JCDR/2022/52388.16110.
11. Jain T, Mohan Y, Maiya GR, Nesan GSCQ, Boominathan C, Eashwar AV. Evaluating the effectiveness of 'AETCOM Module'on the medical interns posted in peripheral health centres of a tertiary care medical college in Kanchipuram, Tamil Nadu. J Family Med Prim Care. 2022 Jun;11(6):2828-2833. doi: 10.4103/jfmpc.jfmpc_1647_21. [PMID: 36119158] [PMCID: PMC9480674]
12. Ghosh A, Bir A. Role of written examination in the assessment of attitude ethics and communication in medical students: Perceptions of medical faculties. J Educ Health Promot. 2021 Jan 28:10:23. doi: 10.4103/jehp.jehp_424_20. [PMID: 33688532] [PMCID: PMC7933678]
13. Jain S, Mahajan G, Mahajan N. SIR approach to teach and learn Attitude, Ethics & Communication (AETCOM). GAIMS Journal of Medical Sciences. 2022;2(1):13-14.
14. National Medical Commission. Attitude, Ethics & Communication (AETCOM) Competencies for the Indian Medical Graduate. New Delhi: National Medical Commission; 2019 [cited 2025 Oct 1]. Available from: https://www.nmc.org.in/information-desk/for-colleges/ug-curriculum/
15. Koehl-Hackert N, Schultz JH, Nikendei C, Möltner A, Gedrose B, van den Bussche H, et al. Burdened into the job -- final-year students' empathy and burnout. Z Evid Fortbild Qual Gesundhwes. 2012;106(2):116-24. doi: 10.1016/j.zefq.2012.02.020. [PMID: 22480895]
16. Ahsin S, Shahid A, Gondal GM. Teaching communication skills and medical ethics to undergraduate medical student. Journal of Advances in Medical Education & Professionalism. 2013; 1(3): 72-6.
17. Mueller PS. Incorporating professionalism into medical education: The Mayo Clinic experience. Keio J Med. 2009 Sep;58(3):133-43. doi: 10.2302/kjm.58.133. [PMID: 19826207]
18. Roberts LW, Warner TD, Hammond KA, Geppert CM, Heinrich T. Becoming a good doctor: Perceived need for ethics training focused on practical and professional development topics. Acad Psychiatry. 2005 Jul-Aug;29(3):301-9. doi: 10.1176/appi.ap.29.3.301. [PMID: 16141129] [PMCID: PMC1599855]
19. De Vignemont F, Jacob P. What is it like to feel another's pain?. Philosophy of Science. 2012 A;79(2):295-316. doi:10.1086/664742.

20. Hirsch EM. The role of empathy in medicine: a medical Student's perspective. Virtual Mentor. 2007 Jun 1;9(6):423-7. doi: 10.1001/virtualmentor.2007.9.6.medu1-0706. [PMID: 23218048]

21. Mukta P Bidikar, Dr Shubhangi Deshmane, Dr Lalita Chandan. Perception of students to AETCOM module on Empathy for First MBBS students. Int J Med Biomed Stud. 2020; 4 (12): 196-8.

Table 2. Medical students' perception of the AETCOM module on "Doctor-patient relationship"

Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	%				
1. Increased knowledge about doctor patient relationship	66.2	29.4	2.4	0	0
2. Helpful in future patient interactions.	65.2	32.1	2.1	0.6	0
3. Useful for gaining patients' confidence and gaining self-confidence	60.5	35.5	3	0.8	0
4. Useful for improving diagnosis in future	57.3	35.6	4	3.1	0
5. Understanding and respecting patients are a good part of the patient-doctor relationship.	79	18.7	1.3	1	0
6. Learned that treating all patients with equanimity is an important aspect of clinical practice.	75.2	24.2	0.6	02	0
7. Gained insight about patient's rights	60	35	4	1	0
8. Gained insight about doctor's right	61.5	32.4	5	1.1	0
9. Satisfied with module.	43	47.1	8.9	0.9	0
10. Should be included in the MBBS curriculum	66.9	30.1	2	1	0

Table 3. Medical students' reflections on their learning experience in the AETCOM session on the doctor-patient relationship

"As a medical student, I will be empathetic to all my patients I will respect them and try to heal them physically and mentally".
"I will be compassionate towards my patients and make them feel as comfortable as possible".
"Empathy for me is keeping myself in somebody else's shoes and feeling his or her feelings/pain. So, I will be empathetic with my patients".
"I will start my therapy after carefully listening to my patient's problems".
"As a doctor, I will try my best to show the right behaviour to my patients".
"I will be kind and compassionate while dealing with my patients".
"I will try to build the trust between my patient and me".
"I will not discriminate between patients based on their socio-economic status or religion".
"I will listen to my patient's problem with patience".
" I will treat my patients with utmost care no matter the situation."
" I will try to develop the right communication skills to build a good doctor-patient relationship".

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Original Article

Investigating the Necessity of Establishing an Academic Major in Health Tourism and Marketing from the Perspective of Faculty Members at Hormozgan University of Medical Sciences

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Abstract

Background: The benefits and development of the health tourism sector highlight the need to train skilled and competent individuals in this field.

Objectives: The current study aimed to determine the necessity of establishing an academic major in health tourism and marketing from the perspective of faculty members at Hormozgan University of Medical Sciences.

Methods: In this analytical cross-sectional study, 177 faculty members at Hormozgan University of Medical Sciences were selected using a stratified sampling method. The research tool was a valid and reliable 31-item, researcher-made questionnaire with a five-point Likert scale. Normal data were analyzed using a one-sample t-test, while non-normal data were analyzed using non-parametric tests, such as the binomial/proportion test, Mann-Whitney U, and Kruskal-Wallis in SPSS software.

Results: Participants believed that Iran holds the necessary capacities for developing health tourism and that the development of this field would benefit the country ($P < 0.050$). The majority of participants (93%), with a mean score of 85.97 ± 2.1, mentioned the necessity of marketing and training specialized human resources in the field of health tourism and marketing. Additionally, 96.04% of participants agreed that developing health tourism and launching an academic major in health tourism and marketing aligned with the general policies and plans of Iran and the Ministry of Health. Moreover, 88.13% of participants considered it necessary to establish an academic major in health tourism within the country ($P < 0.001$).

Conclusion: Based on the results, Iran, with its existing capacities, provides a suitable platform for developing and attracting health tourists. To achieve this, it is necessary to employ specialized personnel in the field of health tourism and marketing, and to train skilled and competent individuals in this field, the establishment of an academic major in health tourism and marketing is essential.

Keywords: Needs Assessment; Marketing; Health Tourism; Medical Tourism

Background

Many researchers today agree on the importance of the global health tourism industry. Due to the substantial revenue it generates for host countries, it remains a key focus for policymakers (1). Health tourism refers to traveling to a location away from one's home to improve mood or health, recuperate, or undergo diagnostic, therapeutic, or medical interventional procedures (2, 3). Health tourism includes wellness tourism, nature therapy tourism, and medical tourism. In wellness tourism, individuals travel without undergoing medical procedures, with the intention of preserving and enhancing their physical and mental health, relieving stress, or re-energizing. In contrast, nature therapy tourism refers to traveling aiming at using natural and traditional treatments (such as hot springs or mud therapy). When an individual travels for the purpose of disease assessment, diagnosis,

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or treatment, it is called medical tourism, which is directly related to a person's health and is therefore considered the most important form of health tourism (2, 4).

Various aspects of health tourism (such as innovation, economics, and marketing) should be taken into account. In recent years, marketing in the field of health tourism has emerged and is currently developing, highlighting a need for further study and attention (5). According to the American Marketing Association's (AMA) definition, marketing is a set of institutions, activities, and processes leading to creating, communicating, delivering, and exchanging offerings that are regarded valuable for customers, employers, partners, and society, at a larger scale (6). Different types of marketing, including electronic marketing, online marketing, integrated marketing, and social marketing, are used to advertise and attract health tourists (7-10).

Countries like Germany, Spain, the United States, Canada, Brazil, Mexico, Egypt, Australia, South Korea, India, and Malaysia have made significant plans, investments, and advancements in health tourism (11, 12). Furthermore, in recent years, regional and neighboring countries like Turkey, Jordan, and the United Arab Emirates have set ambitious goals for health tourism and implemented policies aimed at developing this industry (13-15). In contrast, despite possessing the necessary potential, Iran has not yet achieved significant success in the field of health tourism (16, 17).

Introductory training in health tourism enhances the effectiveness of individuals in this field. Employees who have not completed basic health tourism training often face challenges with communication skills when interacting with health tourists (18). A study conducted in Tabriz on employees at four healthcare centers that host health tourists showed that 43% of these employees were unfamiliar with the concept of health tourism, which presents a significant challenge in this sector (19). The globalization of the health tourism sector increasingly necessitates graduates who can work professionally. Given that health tourism is a high value-added sector, providing academic training and cultivating a professional workforce in this area seems essential. Currently, several countries worldwide offer academic programs to train professionals in health tourism, and there are university graduates with expertise in this field. In total, there are 25 academic programs (in the form of 18 fields of study) ranging from associate to PhD degrees in health tourism in 12 countries, including the United Kingdom, Germany, Austria, Italy, Spain, the United States of America, South Korea, and Turkey. These programs offer majors, such as "Health Tourism, Health Tourism Management, Commercial Tourism, Health and Sports, Health Tourism and Leisure Management, Spa and Wellness Management, etc." (18). Although training conferences and workshops on health tourism are held in Iran, the lack of academic training in this field is particularly noticeable. Hence, policymakers in the country must prioritize the development of a professional workforce in the field of health tourism (20).

One of the inherent duties of the Ministry of Health, Treatment, and Medical Education is to determine the required academic fields of study and educational levels. The lack of efficient and professional personnel in the field of health tourism highlights the need to train skilled and competent individuals in this area. Moreover, in line with the Ministry of Health's Medical Sciences Education Transformation and Innovation Package, one of the goals and executive policies of medical science education is to design new interdisciplinary programs, short-term courses, and research periods based on regional capacities and needs. However, the necessity and needs assessment of academic training and human resource cultivation in this field should first be taken into account. Given that faculty members are considered a group of societal experts and among the most important resources for scientific knowledge and needs assessment in educational design, the present study was conducted to determine the necessity of establishing an academic major in health tourism and marketing from the perspective of faculty members at Hormozgan University of Medical Sciences in 2022.

Objectives

The current study aimed to determine the necessity of establishing an academic major in health tourism and marketing from the perspective of faculty members at Hormozgan University of Medical Sciences.

Methods

This study was applied in terms of its purpose and employed a cross-sectional design. The statistical population consisted of 309 faculty members from 7 faculties and 25 departments at Hormozgan University of Medical Sciences. Faculty members with at least one year of experience who consented and were willing to participate were included in the study, while those who

withdrew, did not complete the questionnaire, or terminated their employment were excluded (Table 1).

Based on the Morgan table, a sample size of 185 was determined. However, due to the exclusion and withdrawal of some participants, 177 faculty members at Hormozgan University of Medical Sciences ultimately participated in the study using a stratified sampling method.

A researcher-made questionnaire was used to collect data. Since no standardized questionnaire existed to investigate this topic, a researcher-made questionnaire was developed and administered. To prepare the questionnaire, we used credible sources, other studies in the field of health tourism, the Ministry of Health's application form for creating educational programs (specifically for needs assessment), and the feasibility study for establishing an academic major at the University of Applied Science and Technology. To compile the questionnaire, we first searched for and reviewed articles on health tourism and marketing in Persian and English from scientific databases [including the Institute for Scientific Information (ISI), Google Scholar, PubMed, and Magiran]. We extracted and reviewed various definitions and classifications of health tourism, and based on these theoretical definitions and classifications, we formulated components of "capabilities and capacities, benefits of developing health tourism, and marketing necessity." Based on a review of the Ministry of Health's application form for creating educational programs (specifically for needs assessment) and the justification plan for the necessity of establishing an academic major at the University of Applied Science and Technology, the components "necessity of training specialized human resources and alignment with policies" were extracted, and corresponding questions were formulated.

The questionnaire was comprised of three sections: Introduction (introducing the questionnaire and stating the research's purpose), personal specifications (gender, field of study, highest academic degree, work experience, academic rank, and faculty of employment), and questions (31 questions/items). The questions were scored using a five-point Likert scale ranging from 1 to 5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree). Each question was assigned a score from 1 to 5. This section evaluated the necessity of establishing an academic major in health tourism and marketing, which included five components: "Capacities and capabilities," "benefits of developing health tourism," "necessity of marketing," "necessity of training specialized human resources," and "alignment with policies."

Questions 1 through 6 focused on the "capacities and capabilities" component, investigating Iran's existing potentials, capacities, and capabilities in natural resources, medical centers, treatment methods, specialists, as well as traditional and modern medical treatments, all in the context of developing health tourism. Questions 7 through 12 focused on the "benefits of developing health tourism," exploring the the existence of economic, health, scientific, political, social, and international benefits of developing health tourism within Iran. Questions 13 through 18 focused on the "necessity of marketing" component, dealing with the importance and need for marketing and public relations at the international scale to develop health tourism in the country. Questions 19 through 24 focused on the "necessity of training specialized human resources" component, examining the need for training expert human resources to develop the health tourism. Finally, questions 25 through 30 focused on the "alignment with policies" component, which includes two distinct sub-sections: "Alignment of health tourism development with the country's general policies and the Ministry of Health's programs and duties" (questions 25-27) and "alignment of establishing an academic major in health tourism and marketing with the country's general policies and the Ministry of Health's programs and duties" (questions 28-30), dealing with the alignment of the health tourism field's growth and development, as well as the establishment of an academic major in this field, with the country's general guidelines and policies, and with the Ministry of Health's overall plans and duties. Question 31 presents the core question of the questionnaire and the research, which is included in the total score of the questionnaire. The total score of the questionnaire ranges from 32 to 155.

After drafting the research questions and designing a researcher-made questionnaire, five experts in curriculum planning, educational research, and medical education evaluated the quality, clarity, comprehensibility, simplicity, and accuracy of the dimensions and questions. They also assessed the relevance of the questions to the research objectives, revised some items, and removed others. Finally, the questionnaire was finalized. Subsequently, the questionnaire was then provided to 10 evaluators (university professors) to assess its content validity [using the content validity index (CVI) and the content

validity ratio (CVR)]. Following the analysis of the results, the CVR and CVI were calculated as 0.80 and 0.94, respectively, which indicated that the questionnaire had good content validity. To determine the questionnaire's reliability, Cronbach's alpha coefficient was used. The questionnaire was administered as a pilot study to 20 faculty members at Hormozgan University of Medical Sciences. The resulting Cronbach's alpha coefficients for the components of "capacities and capabilities," "benefits of developing health tourism," "necessity of marketing," "necessity of training specialized human resources," and "alignment with policies" were reported as 0.85, 0.83, 0.76, 0.74, and 0.90, respectively. The overall Cronbach's alpha for the total scale was reported as 0.90, which confirmed its appropriate reliability.

Initially, the normality of the data was examined using the one-sample Kolmogorov-Smirnov test. Subsequently, the normal data (the capacities and capabilities component) were analyzed using the parametric one-sample t-test, while the non-normal data (other components) were analyzed using non-parametric tests, including the binomial/proportion, Mann-Whitney U, and Kruskal-Wallis tests. All analyses were conducted through SPSS version 24 (IBM Corporation, Armonk, NY).

Since no prior research established a hypothetical mean score for the one-sample t-test, and given that a five-point Likert scale (1 to 5) was employed for scoring the questionnaire in this study, a value of 3 that denoted the intermediate and midpoint score in the answersheet was chosen as a hypothetical mean score for the one-sample t-test. This value was also set as the cutoff point for the Mann-Whitney U and Kruskal-Wallis tests.

Results

The results demonstrated that 55.4% of the participants were female, and 44.6% were male. Furthermore, 53.7% of participants were graduates from medicine, dentistry, pharmacy, or clinical and medical specialties, while 46.03% studied paramedicine, nursing, basic sciences, or other fields. Additionally, 32.2% of participants had 1 to 10 years of work experience, 38.4% had 10 to 20 years, and 29.4% had over 20 years. Regarding academic degrees, 6.2% held a master's/general doctorate degree, 7.4% held a fellowship, 77.3% held a PhD/medical specialty, and 9.1% held a subspecialty. Concerning academic rank, 6.2% of participants were instructors, 68.9% were assistant professors, 20.9% were associate professors, and 0.4% were professors (Table 2).

The results of the one-sample t-test revealed a significant difference in the mean scores of "capacities and capabilities" from the perspective of faculty members at Hormozgan University of Medical Sciences (Table 3). Consequently, with a 95% confidence interval (CI), it can be concluded that these faculty members believe that Iran possesses the necessary capacities and capabilities for the development of health tourism.

Regarding the "benefits of developing health tourism" component, participants believed that the development of health tourism in Iran would bring benefits to the country. Additionally, concerning "the necessity of marketing" component, they commented the necessity of marketing in the field of health tourism in Iran ($P < 0.001$). In terms of the "necessity of training specialized human resources," also, participants believed that training an expert workforce in the fields of health tourism and marketing seemed necessary.

On the "alignment with policies" component (health tourism development), based on the observed ratio, developing health tourism aligned with the overall policies and plans of Iran and the Ministry of Health. Moreover, on the "alignment with policies" component (establishing an academic major), the participants believed that establishing an academic major in the field of health tourism and marketing aligned with the overall policies and plans of Iran and the Ministry of Health. Concerning the necessity of establishing an academic major in health tourism and marketing, the observed ratio of participants believed the necessity of establishing an academic major in health tourism and marketing ($P < 0.001$) (Table 4).

An examination of the differences in the perceived necessity of establishing an academic major in health tourism and marketing and its components among male and female graduates from various academic fields of study, individuals with different academic degrees, academic ranks, and work experience exhibited no significant differences in the mean scores of any of the variables.

Discussion

The present study's findings demonstrated a significant difference between the mean scores of capacities and capabilities from the perspective of faculty members at Hormozgan University of Medical Sciences and the hypothetical mean score of the test. Other studies, in line with the current research, have

suggested that "the quality of healthcare" and "high level of expertise" were two of the most appealing factors in medical tourism in Iran (16). Additionally, with its skilled medical personnel, advanced medical facilities, and high capacity for attracting medical tourists, Iran is considered an important destination for medical tourism globally, particularly within the Islamic world (17). However, some research, contrary to the findings of the present study, has concluded that the coefficient of promotion is unacceptable in public hospitals and at an only moderate level in private hospitals (8).

Moreover, marketing problems, international issues, culture, transfer, brokerage, management, and certain policymaking are among the main barriers to the development of medical tourism in Iran (21).

As revealed by the results of this study, faculty members at Hormozgan University of Medical Sciences believe that developing health tourism in Iran would benefit the country. A study aligned with this research reported that due to its high income and increased therapeutic tourists, medical tourism has become a focus for many countries (17). In addition, as a dimension of tourism, it contributes to a country's sustainable development and economic dynamism and is regarded as a national strategy for raising a country's income and a pillar of national security (19). The connection between the healthcare and tourism industries in many countries has also culminated in the creation of one of the largest service industries, i.e., the "medical tourism industry," which offers significant benefits like job creation and revenue generation (22).

Based on the results, faculty members at Hormozgan University of Medical Sciences believe that marketing in the field of health tourism is essential in Iran. Aligned with the present findings, previous studies have identified "marketing" as one of the most significant factors in the rapid development of health tourism in Iran (23). One of the primary sources for medical tourists when choosing a destination is internet-based information, playing a crucial role in their decision-making. Another key factor is the patient's awareness of the capabilities and expertise of the destination country's medical staff. Creating this awareness requires appropriate advertising and well-structured hospital website content. Additionally, it is crucial to provide information about the various specialties and treatment services available at the destination country's medical centers, as tourists pay close attention to this factor during their decision-making. Patient's awareness of the medical staff's capabilities and expertise necessitates proper advertising, while informing patients about various specialties and services of medical centers, is also considered essential (7). Through integrated marketing, by adopting international standards, hospitals and medical institutions can both enhance their international credibility and build tourists' trust. Increased attention to media advertising can improve the status of hospitals, culminating in attracting more medical tourists and expanding this industry (8). By leveraging social marketing tools, it is also possible to foster a positive perception of a health tourism destination, thereby creating the conditions for people to be more inclined to undertake medical trips (9).

Faculty members at Hormozgan University of Medical Sciences believe the necessity of training specialized human resources in the field of health tourism and marketing. Aligned with the current study's findings, investigations on four hospitals in Tabriz, Iran, revealed that a high percentage of respondents (43.3%) were unfamiliar with the concept of health tourism, presenting a significant challenge to the topic of health tourism (19); of course, even basic training in health tourism enhances an individual's effectiveness. Employers not taken initial health tourism training can merely perform simple tasks, and they often have difficulty communicating with health tourists from diverse cultural backgrounds (18).

According to the results of the current study, faculty members at Hormozgan University of Medical Sciences believe that developing health tourism aligns with the general policies and plans of Iran and the Ministry of Health. A study that supports the findings of the present research showed that medical tourism significantly contributed to the national income of many countries, generating an estimated $100 billion in annual revenue for governments. The Iranian government has plans to cover up to 30% of the country's healthcare needs by the end of the Fourth Development Plan through the export of medical products and services (24).

From the perspective of faculty members at Hormozgan University of Medical Sciences, establishing an academic major in health tourism and marketing aligns with the overall policies and plans of Iran and the Ministry of Health. Consistent with the findings of the present study, previous research has reported that the health tourism market, in addition to facing various challenges, such as the emergence of new players and a lack of a defined mechanism, has suddenly been

confronted with the more significant challenge of widespread presence of inexperienced individuals in this field. On the other hand, Iran's small share of health tourists and its concentration in just a few cities indicate the underdeveloped nature of this sector. Therefore, launching a university course in the field of health tourism presents a golden opportunity to attract investment and build capacity to become an educational hub in the Middle East and West Asia (20).

Finally, according to the obtained results in this research, faculty members at Hormozgan University of Medical Sciences believe that establishing an academic major in health marketing and tourism is necessary. Currently, a total of 25 academic programs (in the form of 18 fields of study) ranging from associate to PhD degrees in the field of health tourism in 12 countries. These include 3 PhD, 10 master, 10 bachelor, and 2 associate programs in the United Kingdom, Croatia, Germany, Austria, Italy, Estonia, Spain, Hungary, the United States of America, Ireland, South Korea, and Turkey, offering majors such as such as "Health Tourism, Health Tourism Management, Commercial Tourism, Health and Sports, Health Tourism and Leisure Management, Spa and Wellness Management, etc." (18). The lack of academic training for health tourism majors is palpable. Therefore, policymakers should consider holding short-term courses and launching an academic program (20). The globalization of the health tourism sector increasingly necessitates graduates who are able to work with various human resources, both domestically and abroad. Given that health tourism is a high value-added sector, and the number of academic programs for increasing professional human resources in this field is insufficient globally, providing academic training and cultivating a professional workforce in this area is essential (18).

The present study's findings revealed that none of the participants' personal specifications, including gender, work experience, academic rank, academic degree, and field of study had a significant effect on the mean scores for the necessity of establishing an academic major in health tourism and marketing and its components. This can be interpreted to mean that all age groups, academic ranks, fields of study, and academic degrees are in agreement regarding the necessity of establishing this academic major and its components.

Health tourism is a competitive industry, and other nations undoubtedly have plans to expand their services. Hence, each country monitors the current activities of its competitors to ensure it is on the right track and has an acceptable rate of growth and progress (16). In Turkey, academic and university education in health tourism is currently provided, with 5 academic programs in the form of two fields of study, including "Health Tourism Management" and "Health Tourism Education" at the master's level, three programs of which are under the supervision of the University of Social Sciences and two at the University of Health Sciences in this country. Additionally, there are two associate academic programs entitled "Health Tourism Management." However, Turkish researchers believe that offering this field of study at the PhD and bachelor's levels is essential (18). In contrast, health tourism in Iran remains underdeveloped and is in its early stages. The Iranian Ministry of Health formally recognized medical tourism in 2003. Subsequently, in 2004, following the integration of the Iranian Cultural Heritage Organization into the Tourism Organization, it was introduced as an independent industry (24). Consequently, it seems that Iran requires immediate and fundamental action in health tourism to avoid falling behind its neighbors and other countries, and is attempting to grow and expand this industry through macro and foundational planning.

Medical tourism is a rapidly growing sector in many countries around the world. Some nations have begun offering academic programs in this area, producing graduates specialized in health tourism. The establishment of a dedicated academic major in health tourism and marketing is a crucial step in developing the healthcare industry. The growth of the health tourism sector, along with the increasing importance of marketing within the healthcare industry, has created a demand for professionals trained in both fields. The establishment of this academic major would help train human resources equipped with a comprehensive understanding of health tourism and marketing principles, as well as the essential skills needed for the effective management and marketing of healthcare services. Additionally, the curriculum should address legal and ethical considerations and emphasize the importance of sustainability within the industry. Students will thus have the opportunity to gain both academic and practical experience through internships and real-world projects, preparing graduates to become leaders, managers, planners, and experts in the field of health tourism and marketing.

A limitation of this study was the difficult and time-consuming process of collecting data from faculty members at Hormozgan University of Medical Sciences due to their heavy workload. Future research is recommended to explore the necessity of establishing an academic major in health tourism and marketing in other academic communities and universities. Additionally, conducting research to design and develop a proposed curriculum for various academic levels of health tourism and marketing field of study could be a valuable future research topic.

Conclusion

With its vast facilities and capacities, Iran provides a suitable platform for expanding health tourism and attracting health tourists. While marketing is essential for attracting health tourists, academic education and the training of skilled and competent professionals in this field are also crucial. Just as leading countries in health tourism have established academic majors and trained specialized human resources in this field in recent years, the establishment of an academic major in health tourism and marketing is a necessary step for the development of the healthcare industry. The growth of the health tourism sector, along with the rising importance of marketing in the healthcare industry, has created a need for specialists who are trained in both fields.

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References

1. Kumar NN, Patel A, Chandra RA, Kumar NN. Publication bias and the tourism-led growth hypothesis. PLoS One. 2021 Oct 14;16(10):e0258730. doi: 10.1371/journal.pone.0258730. [PMID: 34648592] [PMCID: PMC8516250]
2. Smith M, Puczkó L. Health, tourism and hospitality: Spas, wellness and medical travel. 2nd Ed. London: Routledge; 2014. doi:10.4324/9780203083772.
3. Zhong L, Deng B, Morrison AM, Coca-Stefaniak JA, Yang L. Medical, Health and Wellness Tourism Research—A Review of the Literature (1970–2020) and Research Agenda. Int J Environ Res Public Health. 2021 Oct 16;18(20):10875. doi: 10.3390/ijerph182010875. [PMID: 34682622] [PMCID: PMC8536053]
4. Dilmonov KB. Classification and types of tourism. International scientific review. 2020; LXX:41-2.
5. Letunovska N, Kwilinski A, Kaminska B. Scientific research in the health tourism market: a systematic literature review. Health Economics. 2020; 1:9. doi:10.21272/hem.2020.1-01.
6. Brunswick GJ. A chronology of the definition of marketing. Journal of Business & Economics Research. 2014;12(2):105-14. doi:10.19030/jber.v12i2.8523.
7. Saeedbakhsh S, Kazemi A, Nematbakhsh M, Ranjbarian B. Designing an Electronic Marketing Model for Medical Tourism of the Islamic Republic of Iran with the Proposal Systems Approach. New Marketing Research Journal. 2020 Jun 21;10(2):105-28.
8. Taheri Mirghaed M, Ahmadi B, Rahimi Foroushani A, Rajabi Vasoukolaii G, Arab M. The Status of Medical tourism marketing in private and public hospitals affiliated to Tehran university of medical sciences. Payavard Salamat. 2020; 13(6):492-500. [In Persian]
9. Zarei A, Azar A, Rezaei Rad M. Measurement of Social Marketing in Health Tourism. Journal of Tourism Planning and Development. 2016; 5(18): 33-53. [In Persian]
10. Yin J, Chen Y, Ji Y. Effect of the event strength of the coronavirus disease (COVID-19) on potential online organic agricultural product consumption and rural health tourism opportunities. MDE Manage Decis Econ. 2021;42(5): 1156-1171. doi: 10.1002/mde.3298. [PMID: 34149119] [PMCID: PMC8207050]
11. Mainil TJ, Eijgelaar E, Klijs J, Nawijn J, Peeters PM. Research for TRAN committee–health tourism in the EU: a general investigation. Proceedings of the European Parliament TRAN Committee meeting - EU Parliament; 2018 Feb 27; Brussels, Belgium. 2018.
12. Reisman D. Health tourism: Social welfare through international trade. Cheltenham, UK: Edward Elgar Publishing; 2010.
13. Kilavuz E. Medical tourism competition: The case of Turkey. International Journal of Health Management and Tourism. 2018;3(1):42-58.
14. Bulatovic I, Iankova K. Barriers to medical tourism development in the United Arab Emirates (UAE). Int J Environ Res Public Health. 2021 Feb 2;18(3):1365. doi: 10.3390/ijerph18031365. [PMID: 33540935] [PMCID: PMC7908472]
15. Al-Azzam AFM. A study of the impact of marketing mix for attracting medical tourism in Jordan. International Journal of Marketing Studies. 2016;8(1):139-49. doi:10.5539/ijms.v8n1p139.
16. Rezaee R, Mohammadzadeh M. Effective factors in expansion of medical tourism in Iran. Med J Islam Repub Iran. 2016 Sep 5:30:409. [PMID: 27683650] [PMCID: PMC5038994]
17. Mobaraki O, Valigholizadeh A, Nasiri O. The Evaluation of Effective Components on the Development of Medical Tourism in Tabriz city. urban tourism, 2021; 7(4): 145-159. doi: 10.22059/jut.2021.298386.777.
18. Ulusoy H, Tosun N, Akkum B. Health tourism education: the case of turkey and the world. International Journal of Health Management and Tourism. 2018; 3(3): 122-32. doi:10.31201/ijhmt.435707.
19. Panahi H, Azizi M. Evaluating of the capabilities of Tabriz hospitals in the development of health tourism. Journal of Health.

2018 Mar 10;9(1):100-14. [In Persian]
20. Maleki M, Sadeghi NS, Hashemzadeh S, Koohpayehzadeh J, Askari A. Health tourism courses in Iran and the country's potential in becoming the health tourism education hub in the Middle East region. Med J Islam Repub Iran. 2020 Sep 2:34:112. doi: 10.34171/mjiri.34.112. [PMID: 33315997] [PMCID: PMC7722967]
21. Momeni K, Janati A, Imani A, Khodayari-Zarnaq R. Barriers to the development of medical tourism in East Azerbaijan province, Iran: A qualitative study. Tourism Management. 2018; 69: 307-16. doi:10.1016/j.tourman.2018.05.007.
22. Zarchi MK, Jabbari A, Hatam N, Bastani P, Shafaghat T, Fazelzadeh O. Strategic analysis of Shiraz medical tourism industry: a mixed method study. Galen Med J. 2018 Mar 28:7:e1021. doi: 10.22086/gmj.v0i0.1021. [PMID: 34466425] [PMCID: PMC8343818]
23. Asadi MM, Basouli M, Boroumandzad Y, Derakhsh S. Health tourism development with qualitative cognitive mapping approach. Payesh (Health Monitor). 2019 Oct 15;18(5):455-64. [In Persian]
24. Izadi M, Saadat SH, Ayoubian A, Hashemi Dehaghi Z, Karbasi MR, Jalali AR. Health tourism in Iran; identifying obstacles for development of this industry. International Journal of Travel Medicine and Global Health. 2013 Sep 1;1(2):89-94.

Table 1. Frequency distribution of participating faculty members based on faculty

Faculty	Number of Departments	Number of Faculty Members	Frequency and Percentage of Participants
Health	5	28	17 (9.6)
Bandar lengeh nursing	1	4	2 (1.1)
Nursing and midwifery	6	26	16 (9.1)
Medicine	25	185	105 (59.3)
Paramedicine	5	19	12 (6.8)
Pharmacy	5	12	8 (4.5)
Dentistry	10	27	17 (9.6)
Total	57	309	177 (100)

Table 2. Frequency distribution of personal specifications of participating faculty members

Variable	Group	Frequency (Percentage)
Gender	Female	98 (55.4)
	Male	79 (43.6)
Field of study	Medicine, Dentistry, Pharmacy, Clinical and Medical Specialties	95 (53.7)
	Paramedicine, Nursing, Basic Sciences, and other Fields of Study	82 (46.3)
Work experience (years)	1 to 10	57 (32.2)
	10 to 20	68 (38.4)
	Over 20	52 (29.4)
Highest academic degree	Master's/general doctorate	11 (6.2)
	Fellowship	13 (7.4)
	PhD/medical specialty	137 (77.3)
	Subspecialty	16 (9.1)
Academic rank	Instructor	11 (6.2)
	Assistant professor	122 (68.9)
	Associate professor	37 (20.9)
	Professor	7 (4.0)
Total	177 (100)	Total

Table 3. Mean scores of the capacities and capabilities of developing health tourism from the perspective of participating faculty members

Variable	Mean (SD)	T-Value*	P-Value
Capacities and capabilities	89.8 (3.8)	14.561	< 0.001

SD: Standard Deviation
*One-sample t-test

Table 4. The necessity of establishing an academic major in health tourism and marketing and its components from the perspective of participating faculty members

Variable	Category	Cut-off Point	Frequency	Observed Ratio	P-Value*
Benefits of developing health tourism	Does not exist	≥ 3	10	0.06	< 0.001
	Exists	< 3	167	0.94	
Necessity of marketing in health tourism	Does not exist	≥ 3	17	0.10	< 0.001
	Exists	< 3	160	0.90	
Necessity of training specialized human resources	Does not exist	≥ 3	19	0.11	< 0.001
	Exists	< 3	158	0.89	
Alignment with policies (health tourism development)	Does not exist	≥ 3	36	0.20	< 0.001
	Exists	< 3	141	0.80	
Alignment with policies (establishing an academic major)	Does not exist	≥ 3	54	0.31	< 0.001
	Exists	< 3	123	0.69	
Necessity of establishing the field (total score)	Does not exist	≥ 3	8	0.05	< 0.001
	Exists	< 3	169	0.95	

*Binomial/proportion test

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Original Article

Investigating the Impact of Teaching Orthopedic Surgical Technology Course Using a Vertical Integration Approach on Learning Outcomes of Operating Room Students: A Semi-Experimental Study

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Abstract

Background: The primary objective of medical education is to cultivate competent individuals capable of achieving preventive and therapeutic goals and improving community health. To accomplish this, the employment of effective and efficient teaching methods for the precise and systematic organization of educational content is of paramount importance.

Objectives: The current research aimed to investigate the impact of implementing an orthopedic surgical technology training course using a vertical integration approach on learning outcomes, clinical skills, and satisfaction as educational outcomes among operating room students.

Methods: This semi-experimental study was of pretest-posttest type in which 52 fifth semester undergraduate operating room students were recruited using a convenience sampling method. Based on whether or not they had passed the theoretical credit of surgical technology course, they were assigned to the control (non-integrated) or intervention (integrated) groups. In the intervention group, the theoretical and practical topics of the orthopedic surgical technology course were taught using a vertical integration approach, while in the control group, training was conducted using the routine method. Before and after the training, learning outcomes and clinical skills in both groups of students were assessed and compared using a questionnaire and an observational checklist. The data were analyzed using the paired t-test, Wilcoxon test, and analysis of covariance (ANCOVA) in SPSS software.

Results: Based on the paired t-test results, implementing an orthopedic surgical technology training course using a vertical integration approach had a significant impact on learning outcomes and clinical skills in surgical technology ($P < 0.001$). The independent t-test results revealed that the level of satisfaction in the intervention group was significantly higher ($P < 0.001$). According to the results of the ANCOVA, the effectiveness of the vertical integration approach intervention on learning outcomes and clinical skills was reported to be significantly higher than the non-integrated group ($P < 0.001$).

Conclusion: Implementing an orthopedic surgical technology training course using a vertical integration approach can be considered an effective educational strategy that, in addition to improving learning outcomes, can culminate in improved clinical skills and satisfaction among students. Therefore, it is recommended that educational managers in the operating room department pay attention to this matter and provide the conditions for implementing integrated training in their centers.

Keywords: Vertical Integration; Satisfaction; Learning; Clinical Skills; Surgical Technologist

Background

Education is an essential and inseparable element of growth and development, and one of the most important strategies for ensuring success across all social dimensions (1). Medical education, as a type of education in the health system, is responsible for cultivating competent individuals to ensure community health. Since Flexner's time, this type of education has been designed in such a way that medical students first

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learn basic sciences and then clinical sciences (2). In recent decades, due to the inability of this educational approach to establish a connection between basic and clinical sciences for students, it has been criticized (3). Therefore, we have witnessed major transformations in the implementation of curricula and their reform toward concept-based educational programs. In implementing these programs, organizing materials for retrieval in similar situations and better consolidation of materials in long-term memory takes place better and easier, and learning theoretical topics is developed with a focus on their clinical practice (4, 5). The presentation of materials in concept-based educational programs with an integration approach gives rise to the organization of curricular materials that are often taught in separate courses or departments at the university (6). In this educational model, learning becomes enjoyable for learners due to the creation of a real and engaging learning environment (7). Thus, the achievement of educational goals is improved. Curriculum integration is implemented in two general forms: Horizontal and vertical (8). In horizontal integration, curricular topics that revolve around a common concept are taught together and around a central theme or concept (9). For example, professors from different departments address different aspects of respiratory diseases, including diagnosis, treatment, etc. However, in vertical integration, basic and clinical sciences are implemented simultaneously in such a way that, by implementing these educational programs, instead of being taught theoretical aspects in one semester and then the practical and clinical aspects of the same topics in another semester, students are required to receive and practice clinical cases related to that topic simultaneously with acquiring theoretical knowledge, according to the program and in the same semester (10). It is believed that vertical integration is a more efficient method than horizontal integration in clinical fields, culminating in a deeper understanding of basic sciences and facilitating the socialization of students in the medical profession (10, 11).

Numerous studies have demonstrated improved student attitudes toward basic sciences, deeper and more comprehensive learning, and the acquisition of higher-level skills following the implementation of vertical integration of courses in medical curricula (12, 13). However, research in other disciplines is very limited. One such group is surgical technology students, who complete their education in a four-year program in university classrooms and operating room environments. Undoubtedly, training competent students with a high level of knowledge and clinical skills can guarantee patient safety and achieving positive surgical outcomes (14), students who work closely alongside surgeons and, in some cases, one step ahead of surgeons to be able to satisfy the needs of surgery as quickly as possible and complete surgical procedures (15, 16). Achieving this goal requires recognition of the curriculum and effective teaching models, including the integration model, the benefits of which were discussed in the previous section. Obviously, training surgical technology students through a vertically integrated approach, in which they can practice and experience the knowledge they acquire in the classroom in conjunction with the real-world operating room environment, seems necessary (17). One of the main courses for operating room students is surgical technology courses in various surgeries, including orthopedic surgery, where students, in addition to theoretical familiarity with the anatomy and physiology of bones and orthopedic diseases, are required to recognize and apply specialized tools and equipment for performing various orthopedic surgeries and providing preoperative, intraoperative, and postoperative care in the role of a circulating nurse and scrub nurse. Currently, students take the theoretical aspects of the course in one semester and the practical aspects as an internship in the following semester. This separate presentation of the courses causes students to forget many of the topics during the semesters in which they are doing internships and face challenges in the operating room environment. Therefore, the present research aimed to determine the impact of implementing the teaching of the orthopedic surgical technology course using a vertical integration approach on students' learning outcomes, clinical skills, and satisfaction.

Objectives

The current research aimed to investigate the impact of implementing an orthopedic surgical technology training course using a vertical integration approach on learning outcomes, clinical skills, and satisfaction as educational outcomes among operating room students.

Methods

Study Design: This semi-experimental study as a pretest-posttest, two-group design with an intervention and a control group was conducted at Iran University of Medical Sciences in 2023-2024.

Participants: The sample consisted of 52 undergraduate students studying in operating room

technology field of study, who were selected according to the inclusion criteria, including consent to participate in the study and either taking or having completed the orthopedic surgery technology theoretical course and the surgical technique internship course. Samples were assigned to either the control group (non-integrated, n = 24) or the intervention group (integrated, n = 28) based on whether they had completed the orthopedic surgery technology theoretical course.

Procedure: This research was designed and implemented in two phases: Design and intervention. In the design phase, the researcher collaborated with experts from the operating room, orthopedics, and medical education during several meetings to develop the educational objectives, implementation plan, and evaluation tools for the intervention group. Subsequently, in the intervention phase, the researcher held a meeting with students who met the inclusion criteria to explain the educational objectives of the course and the implementation process. Participants were then asked to complete a demographic information form and the learning pretest questions (consisting of 40 questions) within 30 minutes. Additionally, in both groups in the practical unit, a pretest of clinical skills was assessed using a researcher-developed checklist. These two scores, measuring learning outcomes and practical skills, served as the baseline assessment criterion (pretest) for the learners.

Then, based on the teaching course plan (Appendix 1), the intervention group received 14 sessions of case-based training using a vertical integration approach. This training involved theoretical training followed by clinical skills training at medical centers on relevant topics, such as anatomy and physiology, identifying specialized instruments and equipment in orthopedic surgery, examining bone pathophysiology, fracture management, and orthopedic diseases, examining upper extremity fractures, shoulder girdle fractures, thoracic fractures, lower extremity fractures, total knee, hip, and shoulder arthroplasty, ligament injuries of the knee and shoulder and their surgical management, and amputation.

In the practical training of the integrated group, an orthopedic patient on the operating room list was selected based on the educational objectives. The instructor (researcher) then explained the surgical procedure and technique. Additionally, instruments and equipment required in surgery were described, along with safety precautions. All preoperative, intraoperative, and postoperative care measures according to the patient's specific condition were also discussed. All taught content was practically repeated and reviewed with the students during the surgery.

The control group, which had completed the theoretical courses in the previous semester, participated in a surgical technique internship conducted in a routine manner under the supervision of the researcher. At the end of the internship, a posttest, involving assessments of learning outcomes and clinical skills, was administered to both groups of students to evaluate the impact of the curriculum on students' learning outcomes and clinical skills. Furthermore, a satisfaction survey regarding the teaching method was completed by students in both groups. The flowchart of the study is displayed in Figure 1.

Data Collection Tools: Data collection tools comprised a multiple-choice exam to assess learning, a checklist to evaluate clinical skills, and a questionnaire to measure student satisfaction. The multiple-choice exam on learning contained 40 questions in the domains of anatomy, terminology, physiology, pathophysiology, diagnostic tests and procedures, surgical attention and care, surgical instruments and equipment, surgical procedures, and postoperative procedures and care. The skill assessment checklist included 133 questions in the domains of scrubbing (hand washing), hand drying, gowning, closed gloving, gowning and gloving a surgeon, setting up the surgical table, identifying surgical instruments, prepping, draping, counting gauze, needles, and sponges, suturing, and removing gowns and gloves. Ultimately, the satisfaction questionnaire consisted of 20 questions to assess satisfaction with clinical and theoretical teaching methods and related items, academic motivation, teaching and management of issues, such as clinical judgment, self-confidence, communication skills, course content, and principles related to orthopedic surgery.

The scientific validity of all three tools was assessed using content validity and a survey of operating room and medical education experts, in such a way that in the qualitative content analysis, the researcher asked experts to assess the tools qualitatively and provide feedback, based on which the necessary modifications were made. In order to assess the reliability of the tools (questionnaire) in the learning and satisfaction sections, Cronbach's alpha coefficient was calculated and the internal consistency of the questions was determined, and their reliability was thus approved at 0.84 and 0.87, respectively.

To ensure the reliability of the clinical skills tool (observational checklist), the test-retest method using two raters was employed. The correlation between the scores given by the two raters was greater than 0.90. For the learning and skill sections, the content validity index (CVI) was 0.83 and 0.80, and the content validity ratio (CVR) was 0.82 and 0.85, respectively. Based on the Lawshe table, the tool's content validity was confirmed.

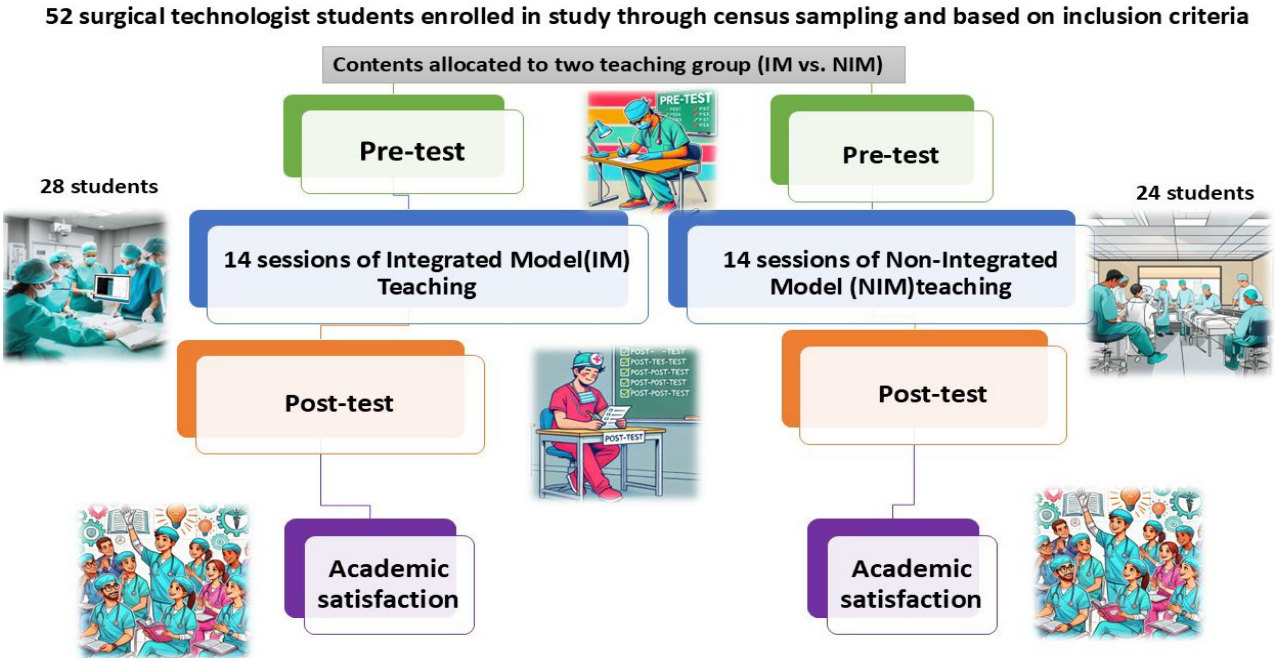

Figure 1. Flowchart of implementing an integrated and non-integrated educational program in the intervention and control groups

Data Analysis: The findings section first described the variables using means and standard deviations. A paired t-test was used to compare the within-group mean scores. The independent t-test was used to examine the level of satisfaction between the two groups. Additionally, analysis of covariance (ANCOVA) and multivariate analysis of covariance (MANCOVA) were employed to compare the effectiveness of the intervention on the two variables of learning outcomes and clinical skills. Moreover, the assumptions of parametric ANCOVA, including the absence of outliers, normal distribution of data, homogeneity of variances, homogeneity of regression slopes, and homogeneity of variance-covariance matrices, were examined and found to be met. Finally, the data were analyzed using SPSS version 28 (IBM Corporation, Armonk, NY). The significance level was set at $P < 0.05$.

Results

In the present study, the integrated group consisted of 28 individuals, and the non-integrated group comprised 24 participants. Results revealed that there were no significant differences between the two groups in terms of demographic characteristics, such as gender, grade point average (GPA), and age. In addition, based on the significance levels of Fisher's exact test and the independent t-test, which were higher than 0.05, it can be concluded that the two groups were homogeneous regarding gender, GPA, and age ($P > 0.05$). In terms of gender, most participants in both groups were female. The GPAs of the integrated and non-integrated groups were 16.78 and 17.25, respectively, which were similar. The mean age was 21.61 years in the integrated group and 21.42 years in the non-integrated group, which were similar. A description of learning and its components in the two groups is presented in Table 1, and the mean posttest and pretest times were compared using a paired t-test (within-group comparison).

The results of Table 1 demonstrated that the mean score of learning in the integrated group was 5.16 in the pretest. In the posttest, the mean score of learning demonstrated a substantial increase of 11.38 points, reaching to 16.54. In the integrated group, the mean posttest time increased in all three learning components so that in basic skills, it increased from 2.14 to 6.55. In surgical procedures, this score increased from 2.04 to 7.77, and in preoperative and postoperative care, it increased from 0.98 to 2.21. Moreover, the mean score of learning in the non-integrated group was obtained to

be 10.90 in the pretest. In the posttest, the mean score of learning demonstrated a substantial increase of 1.45 points, reaching to 12.35. These findings indicate a smaller increase in learning outcomes in the non-integrated group compared to the integrated group.

Table 1. Comparing the results of learning components at two time points between integrated and non-integrated groups using the paired t-test

Variable	Time	Integrated Group		Non- integrated Group	
		Mean (SD)	P-value	Mean (SD)	P-value
Basic skills	Pretest	2.14 (1.45)	< 0.001	4.73 (0.83)	0.524
	Posttest	6.55 (1.20)		4.79 (0.75)	
Surgical procedure	Pretest	2.04 (1.65)	< 0.001	4.44 (1.41)	0.009
	Posttest	7.77 (1.46)		5.50 (1.10)	
Preoperative and postoperative care	Pretest	0.98 (0.76)	< 0.001	1.73 (0.39)	0.003
	Posttest	2.21 (0.50)		2.06 (0.37)	
Learning score (total)	Pretest	5.16 (3.42)	< 0.001	10.90 (2.12)	0.003
	Posttest	16.54 (2.61)		12.35 (1.51)	

SD: Standard deviation

The results of the paired t-test revealed that in both the integrated and non-integrated groups, the mean scores of learning and all components were significantly higher in the posttest than in the pretest (P < 0.050).

Table 2 presents a description of clinical skills and their components in the two groups. The mean posttest and pretest times were compared using a paired t-test (within-group comparison).

The results of Table 2 revealed that the mean score of clinical skills in the integrated group was 203.18 in the pretest. In the posttest, the mean score of clinical skills demonstrated a substantial increase of 234.82 points, reaching to 438.00. In the integrated group, the mean posttest time increased for all 12 indicators of clinical skills.

In the non-integrated group, the mean score of clinical skills was 289.54 in the pretest. In the posttest, the mean score of clinical skills demonstrated a substantial increase of 93.96 points, reaching to 383.50, which indicates a significant increase in clinical skills in the posttest. Moreover, the mean posttest time increased for all 12 indicators of clinical skills. Based on the paired t-test results, the mean scores of clinical skills and all its 12 indicators were significantly higher in the posttest than in the pretest in both the integrated and non-integrated groups (P < 0.050).

Table 2. Comparing the results of clinical skills component at two time points between integrated and non-integrated groups using the paired t-test

Variable	Time	Integrated Group		Non-integrated Group	
		Mean (SD)	P-value	Mean (SD)	P-value
Scrubbing	Pretest	69.82 (10.41)	< 0.001	89.67 (18.43)	< 0.001
	Posttest	129.21 (13.27)		114.75 (15.72)	
Hand drying	Pretest	12.04 (1.26)	< 0.001	14.67 (2.10)	< 0.001
	Posttest	17.79 (1.75)		17.75 (1.33)	
Gowning	Pretest	10.14 (0.76)	< 0.001	15.38 (2.37)	< 0.001
	Posttest	19.79 (0.83)		18.08 (1.84)	
Closed gloving	Pretest	19.50 (1.73)	< 0.001	28.83 (4.54)	< 0.001
	Posttest	34.21 (2.62)		33.63 (3.49)	
Gowning and gloving a surgeon	Pretest	8.36 (1.34)	< 0.001	10.67 (2.16)	< 0.001
	Posttest	13.82 (1.49)		13.12 (2.47)	
Setting up the surgical table	Pretest	10.93 (5.13)	< 0.001	29.25 (3.15)	< 0.001
	Posttest	53.54 (4.79)		42.58 (4.76)	
Identifying surgical instruments	Pretest	8.64 (4.97)	< 0.001	21.17 (2.53)	< 0.001
	Posttest	45.43 (4.01)		34.96 (4.96)	
Prepping	Pretest	19.11 (3.78)	< 0.001	21.17 (3.80)	< 0.001
	Posttest	38.14 (2.98)		32.42 (5.48)	
Draping	Pretest	11.96 (3.70)	< 0.001	16.04 (3.07)	< 0.001
	Posttest	25.64 (2.82)		22.04 (2.93)	

Counting gauze, needles, and sponges	Pretest	8.68 (1.34)	< 0.001	11.58 (1.93)	< 0.001
	Posttest	17.32 (1.66)		14.50 (2.86)	
Suturing	Pretest	14.79 (2.92)	< 0.001	18.92 (2.80)	< 0.001
	Posttest	26.21 (3.28)		24.29 (2.26)	
Removing gowns and gloves	Pretest	9.21 (1.69)	< 0.001	12.08 (1.64)	< 0.001
	Posttest	16.89 (1.47)		15.38 (1.38)	
Clinical skills (total score)	Pretest	203.18 (23.49)		289. 54 (35.72)	< 0.001
	Posttest	438.00 (29.94)		383.50 (36.59)	

SD: Standard deviation

Table 3. The results of the analysis of covariance to compare the effectiveness of the intervention on learning outcomes and clinical skills

Source of Variation	Dependent Variable	Comparison of Mean Scores	F		P-Value	Effect Size
		Mean Difference*	SD			
Group	Basic skills	1.97	0.43	21.28	< 0.001	0.312
	Surgical procedure	1.77	0.52	11.63	< 0.001	0.198
	Preoperative and postoperative care	0.10	0.18	0.31	0.584	0.006
	Learning score (Total)	3.59	0.86	17.47	< 0.001	0.263
	Scrubbing	47.91	6.63	52.14	< 0.001	0.578
	Hand drying	3.08	1.01	9.34	0.004	0.197
	Gowning	4.44	0.84	27.69	< 0.001	0.421
	Closed gloving	6.39	2.31	7.64	0.009	0.167
	Gowning and gloving a surgeon	5.05	1.20	17.83	< 0.001	0.319
	Setting up the surgical table	13.47	4.15	10.55	0.002	0.217
	Identifying surgical instruments	17.79	3.55	25.06	< 0.001	0.397
	Prepping	11.42	3.17	12.98	< 0.001	0.255
	Draping	8.53	1.86	21.11	< 0.001	0.357
	Counting gauze, needles, and sponges	3.89	1.46	7.09	0.011	0.157
	Suturing	3.10	2.75	1.27	0.267	0.032
	Removing gowns and gloves	4.19	1.25	11.18	0.002	0.227
	Clinical skills (total score)	133.98	9.38	204.15	< 0.001	0.806

SD: Standard deviation

*The difference in mean scores refers to the adjusted posttest mean score after controlling for the pretest score of the variable in the two groups.

Table 3 presents the ANCOVA results to compare the effectiveness of the two teaching methods on learning outcomes and clinical skills. ANCOVA was used for the total scores of the variables, and MANCOVA was used for the components.

Table 3 presents the results of the ANCOVA, indicating that the intervention was effective in improving learning outcomes and clinical skills ($P < 0.050$). The significance level for the total scores of learning outcomes and clinical skills was less than 0.05., suggesting that the integrated group had a significantly greater impact on the improvement of learning outcomes and clinical skills was than the non-integrated group. A comparison of effect sizes using partial eta-squared revealed that the intervention's impact on the improvement of clinical skills was greater than that on learning outcomes (0.806 versus 0.263). The findings confirmed the integrated group's impact on the two learning components, including basic skills and surgical procedure, as well as on all components of clinical skills except for suturing ($P < 0.050$). Effect size values reported that the highest intervention effectiveness among learning components was related to basic skills (coefficient = 0.312), and among components of clinical skill, it belonged to scrubbing (coefficient = 0.578), gowning (coefficient = 0.421), and identifying surgical instrument (coefficient = 0.397).

Table 4 compares the levels of satisfaction of the two groups using an independent t-test. Level of satisfaction was measured once, after the intervention. The comparison of satisfaction in Table 4 showed that the level of satisfaction was 82.11 in the integrated group and was 67.25 in the non-integrated group, with a mean difference of 14.86, indicating higher satisfaction in the integrated group. According to the independent t-test results, the level of satisfaction was significantly higher in the integrated group than in the non-integrated group ($P < 0.050$).

Discussion

Based on the present study results, the implementation of an orthopedic surgical technology training course using a vertical integration approach significantly impacted learning outcomes, clinical skills, and satisfaction of surgical technology students so that a significant difference was observed in the mean scores of learning tests, clinical skills, and satisfaction among the two groups.

Table 4. Comparing levels of satisfaction between the integrated and non-integrated groups using the independent t-test

Independent Variable	Integrated Group	Non-integrated Group	P-Value
	Mean (SD)	Mean (SD)	
Satisfaction	67.25 (10.56)	82.11 (11.41)	< 0.001

SD: Standard deviation

The findings of the present study align with those of Mattout et al.'s research, conducted to investigate the use of a realistic simulation scenario as a vertical integration teaching tool for medical students. The researchers reported in the mentioned research that this teaching method facilitated memorization and better learning (18). Daniel and Joseph, in Pennsylvania, also examined the impact of horizontal integration in nursing curriculum and concluded that the integration teaching method culminated in a better understanding of concepts and increased interactive learning (19), which is consistent with the results of the present study. The findings of Dulloo et al.'s study, which was conducted to investigate the effect of horizontal and vertical integration on students' learning and perception (20), were also consistent with the results of the present study. Sadati et al.'s study, conducted aiming to compare two task-based and routine teaching methods in terms of students' knowledge, explained that the level of awareness among students had increased and that the implementation of new training method was effective in learning (21). The mentioned study yielded similar results and was consistent with the findings of the present study. By evaluating the implementation of vertical integration of the pathology course in medical students studying in the three first years, Bhatti et al. stated that most students, after the implementation of vertical integration of the pathology course, considered it effective in achieving the course objectives and reported that this method helped them to gain a better conceptual understanding of the main topics in pathology (22).

In clarifying the materials mentioned above, it can be concluded that the implementation of innovative educational programs, particularly the integrated approach, can significantly enhance the quality of learning and knowledge acquisition among students. In this integrated educational method, students have better opportunities through objective observation and can apply and solidify their understanding of concepts through clinical experiences.

The findings of the present study revealed that students' clinical and practical skills also improved due to increased self-confidence, surgical management, interpersonal communication, and a higher level of knowledge. The results of Wijnen-Meijer et al.'s research, aimed at determining the performance differences between graduates of vertical integrated and non-integrated curricula (11), were consistent with the findings of the present study. They reported that the active professional development and performance of students in the integrated group were more reliable. Additionally, Yousefi et al.'s study, which investigated the impact of feedback-based training on intravenous line insertion skills, reported a significant improvement in students' intravenous line insertion skills (23), further supporting the usefulness of the proposed innovative educational approach and being consistent with the findings of the current study.

In Ebrahimpour and Imanipour's study, aimed at establishing a connection between theoretical knowledge about the concept of pain and its practical application in the format of a game-based competition among nursing students, it was reported that skills such as time management, optimal utilization of equipment and facilities, and teamwork improved, and This type of planning was accompanied by an improvement in quality (24). These findings were similar to the results of the present study. Training theoretical concepts in integration with practical concepts, due to the simultaneous engagement of the learner with a real-world situation consistent with Kolb's learning theory, provides a condition for the learner to have an easier and better understanding of the material in similar situations

(25). This leads to better learning of procedures and acquisition of skills. The results of Sadati et al.'s study on the education of surgical residents through the design of educational boot camps that included teaching and practicing basic surgical skills (26) support this finding.

Our findings regarding student satisfaction with teaching through the integrated approach also demonstrated an increase in student interest. Additionally, students reported a growth in their academic motivation. In a survey, students attributed this increased satisfaction to improved clinical performance, enhanced power of clinical judgment, and a better understanding of the taught material. Ultimately, they recommended this teaching method to their peers. The results align with the research conducted by Amini et al. to investigate the effect of integrating basic and clinical aspects on student satisfaction with the integrated teaching approach (10). Both studies highlighted the effectiveness of integrated approach in fostering academic motivation and a positive learning incentive. Similarly, Chhabra et al.'s research, aimed to investigate the effect of vertical integration in teaching, reported this training approach to be highly beneficial and advocated for conducting courses using this approach (6). Our findings corroborate these results. Daniel and Joseph also described this innovative approach as groundbreaking. They reported a 100% attendance rate, which they attributed to increased student motivation (19). These findings are consistent with our research.

Overall, a comparison of the effectiveness of the integrated and non-integrated methods using ANCOVA revealed that the integrated group showed significantly higher effectiveness in improving learning and clinical skills compared to the non-integrated group. However, results from some studies demonstrate that if there is insufficient preparedness among professors and students, and if inappropriate content is selected for integration, it may not only be ineffective in improving learning but may also culminate in student dissatisfaction due to increased engagement time (27). Therefore, the selection of appropriate content related to the internship in the present study appears to be one of the strengths in introducing the vertical integration approach in teaching undergraduate operating room courses, which can serve as a model for professors in Iran and other countries with similar educational programs.

Limitations: The small sample size in both groups and the fact that the internships were conducted in different operating rooms, which could have been influenced by varying educational atmospheres and impacted student learning outcomes and satisfaction, which was beyond the researchers' control, were among the limitations of this study. Additionally, despite advising students against sharing data, due to interactions among students, data exchange may have occurred in some cases, which was beyond the researchers' control. Another limitation of this study was the teaching method of theoretical materials in the control group, in which the researchers had no involvement in its design and only relied on the lesson plan provided by the respective professor, with all content being in accordance with the relevant curriculum.

Conclusion

The present study results demonstrated that the implementation of an orthopedic surgical technology training course using a vertical integration approach can serve as an effective educational strategy, not only enhancing learning outcomes but also improving clinical skills and student satisfaction. Therefore, it is recommended that this training approach be considered by administrators and executive officials in the education of operating room technology students in order to enhance learning, improve skills, and ensure patient safety.

Supplementary Material(s): is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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Conflict of interests: There is no conflict of interest.

Ethical approval: The present study has been extracted from a master's thesis in Operating Room, approved by Iran University of Medical Sciences (ethics code: IR.IUMS.REC.1402.548).

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References

1. Desha C, Rowe D, Hargreaves D. A review of progress and opportunities to foster development of sustainability-related competencies in engineering education. Australasian Journal of Engineering Education. 2019;24(2): 61-73. doi: 10.1080/22054952.2019.1696652.
2. Chhatria S, Pani B, Sangeeta M. Principles and Approaches to Curriculum Development. Journal of Higher Education Theory and Practice. 2024;24(1):51-64.
3. Quintero GA, Vergel J, Arredondo M, Ariza M-C, Gómez P, Pinzon-Barrios A-M. Integrated medical curriculum: advantages and disadvantages. J Med Educ Curric Dev. 2016 Oct 11:3:JMECD.S18920. doi: 10.4137/JMECD.S18920. [PMID: 29349303] [PMCID: PMC5736212]
4. Hendricks SM, Wangerin V. Concept-based curriculum: Changing attitudes and overcoming barriers. Nurse Educ. 2017 May/Jun;42(3):138-142. doi: 10.1097/NNE.0000000000000335. [PMID: 27723680]
5. Karami S, Sadati L, Nouri Khaneghah Z, Rahimzadeh M. Iranian Measure of Operating Theatre Educational Climate (IMOTEC): Validity and Reliability Study. Strides Dev Med Educ. 2022;19(1):150-7. doi: 10.22062/sdme.2022.197859.1119.
6. Chhabra S, Mohammed S, Bhatia P, Ghatak S, Paliwal B, Soni P. Vertical integration in postgraduate teaching for anaesthesiology residents: A questionnaire based descriptive cross-sectional study. Med J Armed Forces India. 2021 Feb;77(Suppl 1): S220-S226. doi: 10.1016/j.mjafi.2021.01.003. [PMID: 33612957] [PMCID: PMC7873754]
7. Mahakizadeh S, Khorasani S, Sadati L, Arabi M, Kermanian F. Vertical Integration in Visual System Education: A New Educational Experience. Strides Dev Med Educ. 2024;21(1):108-12. doi: 10.22062/sdme.2024.198692.1226.
8. Wijnen-Meijer M, Van den Broek S, Koens F, Ten Cate O. Vertical integration in medical education: the broader perspective. BMC Med Educ. 2020 Dec 14;20(1):509. doi: 10.1186/s12909-020-02433-6. [PMID: 33317495] [PMCID: PMC7737281]
9. Husain M, Khan S, Badyal D. Integration in medical education. Indian Pediatr. 2020 Sep 15;57(9):842-847. doi: 10.1007/s13312-020-1964-x. [PMID: 32999111]
10. Amini M, Mikaeili F, Handjani F, Hatam G, Asgari Q. The effect of integration of basic and clinical aspects of a specific topic in a parasitology course on medical students learning: A randomized controlled trial. J Educ Health Promot. 2021 Oct 29:10:390. doi: 10.4103/jehp.jehp_1656_20. [PMID: 34912926] [PMCID: PMC8641709]
11. Wijnen-Meijer M, Ten Cate O, van der Schaaf M, Burgers C, Borleffs J, Harendza S. Vertically integrated medical education and the readiness for practice of graduates. BMC Med Educ. 2015 Dec 21:15:229. doi: 10.1186/s12909-015-0514-z. [PMID: 26689282] [PMCID: PMC4687104]
12. van der Hoeven D, Zhu L, Busaidy K, Quock RL, Holland JN, van der Hoeven R. Integration of basic and clinical sciences: Student perceptions. Med Sci Educ. 2019 Dec 13;30(1):243-252. doi: 10.1007/s40670-019-00884-1. [PMID: 34457664] [PMCID: PMC8368397]
13. Kumaravel B, Jenkins H, Chepkin S, Kirisnathas S, Hearn J, Stocker C, et al. A prospective study evaluating the integration of a multifaceted evidence-based medicine curriculum into early years in an undergraduate medical school. BMC Med Educ. 2020 Aug 24;20(1):278. doi: 10.1186/s12909-020-02140-2. [PMID: 32838775] [PMCID: PMC7445898]
14. Eslami M, Ahmadipour H, Bagheri F. Psychometric properties of the Persian version of Whiteley Index. Russian Open Medical Journal. 2017;6(3):e0307. doi: 10.15275/rusomj.2017.0307.
15. Hall S, Quick J, Hall A. The Perfect Surgical Assistant: Calm, Confident, Competent and Courageous. J Perioper Pract. 2016 Sep;26(9):201-4. doi: 10.1177/175045891602600903. [PMID: 29328813]
16. White T. The Nurse Practitioner as Surgical Assistant. AACN Adv Crit Care. 2016 Jul;27(3):263-265. doi: 10.4037/aacnacc2016216. [PMID: 27959307]
17. Haddad DN, Resnick MJ, Nikpay SS. Does vertical integration improve access to surgical care for Medicaid beneficiaries? J Am Coll Surg. 2020 Jan;230(1):130-135.e4. doi: 10.1016/j.jamcollsurg.2019.09.016. [PMID: 31672671] [PMCID: PMC9109457]
18. Mattout SK, Shah BM, Khan MM, Mitwally NA, Al Aseri ZA, Yousef EM. Realistic simulation case scenario as a vertical integration teaching tool for medical students: A mixed methods study. J Taibah Univ Med Sci. 2023 Aug 22;18(6):1536-1544. doi: 10.1016/j.jtumed.2023.08.001. [PMID: 37701845] [PMCID: PMC10494172]
19. Daniel M, Joseph RA. Horizontal integration of concepts: an innovative teaching strategy. Nurse Educ. 2019 Sep/Oct;44(5):284-287. doi: 10.1097/NNE.0000000000000608. [PMID: 30308567]
20. Dulloo P, Vedi N, Gandotra A. Impact of horizontal and vertical integration: Learning and perception in first-year medical students. National Journal of Physiology, Pharmacy and Pharmacology. 2017;7(11):1170-6. doi: 10.5455/njppp.2017.7.0519113062017.
21. Sadati L, Hannani S, Sarraf N, Azadi N. Comparison of task-based learning and current method of teaching on the knowledge and practice skill of surgical technologists in Iran University of Medical Sciences. Education Strategies in Medical Sciences. 2020;13(3):213-9. [In Persian]
22. Bhatti MM, Ahmed S, Habib M, Fahim H, Mudassir G, Ahmad RN. Vertical integration of pathology in first two years of MBBS program: learning and perceptions of students. Rawal Medical Journal. 2022;47(2): 442.
23. Fereidouni Golsifi A, Yousefi H. Evaluation of the Effect of Feedback-based Education of IV Insertion Skills to Undergraduate Nursing Students. Journal of Medical Education Development. 2021;14(42):46-53. doi: 10.52547/edcj.14.42.46.
24. Ebrahimpour F, Imanipour M. Vertical integration through an innovative gamification in nursing education. Proceedings of the In Sigma's VIRTUAL 31st International Nursing Research Congress; 2020 July 22-4; Washington, USA. 2020.
25. Kolb DA. Experiential learning: Experience as the source of learning and development: 2nd ed. New Jersey: FT Press; 2014.
26. Sadati L, Karami S, Edalattalab F, Hajati N, Azarsina S, Abjar R. Designing, implementing, and evaluating a basic surgical skills bootcamp: An effective approach to enhance competency in surgical residency training. Surgeon. 2024 Dec;22(6):e208-e212. doi: 10.1016/j.surge.2024.08.008. [PMID: 39174363]
27. Arain SA, Kumar S, Yaqinuddin A, Meo SA. Vertical integration of head, neck, and special senses module in undergraduate medical curriculum. Adv Physiol Educ. 2020 Sep 1;44(3):344-9. doi: 10.1152/advan.00173.2019. [PMID: 32568004]

Appendix 1. Daily Lesson Plan Structure

Academic Year: 2023-2024	**Course Presentation Date: 04/10/2023**
Faculty: Paramedical Sciences	Course Type: Theoretical
Degree/Field of Study: Bachelor of Science in Operating Room	Instructor: Yaghmaei
Course (Credit) Title: Orthopedic Surgical Technology and Related Care	Number of Students: 28
Semester : 5	Class Duration: 120 minutes

Main Source of the Lesson:
Sadati, Leila. Golchini, Ehsan. Digestive and endocrine technology. Jame'e Negar Publications, 2015
Supplementary Learning Sources:
Surgical technology for the surgical technologist: A positive care approach /Association of Surgical Technologists / Cengage Learning; last edition /
Berry & Kohn's Operating Room Technique / Nancymarie Phillips RN PhD RNFA CNOR (Author) / Mosby; last edition

Educational Facilities: Whiteboard, video projector, instructional videos, mobile phone, laptop

Course Title: Orthopedic Surgical Technology and Related Care

Major Course Objective: To familiarize students with the concepts related to orthopedic surgery. (This session: Upper extremity fractures)

Minor Objectives:

- Describe the anatomy of bone, tendon, and joint tissues in the upper extremities.
- Explain the pathophysiology of joint and bone diseases in the upper extremities.
- Describe the most common fractures in the upper extremities.
- List the specialized instruments and equipment used in upper extremity surgeries.
- Compare the fracture surgical techniques and repair methods for in various upper extremity surgeries.
- Explain the roles of the circulating nurse and scrub nurse in the surgical process of upper extremity surgeries.

Describe the preoperative, intraoperative, and postoperative care for patients undergoing upper extremity surgery.

Teaching Method: Interactive, case-based teaching

Lesson Components and Presentation Methods: The lesson components and presentation methods are performed through a combination of various media formats, including PowerPoint presentations, educational videos, images, etc., depending on the specific content and established learning objectives.

Duration: 10 minutes	**Introduction**
• **Course Overview**	Duration: 20 minutes
▪ Part I of the lesson	Duration: 30 minutes
▪ Question and Answer and Rest	Duration: 30 minutes
▪ Part II of the lesson	
Summary and Conclusion	Duration: 15 minutes

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Original Article

Designing and Building a Mobile Educational Software Application for the Laboratory of Morphology and Physiology of Medically Important Insects and Assessing Students' Satisfaction Levels

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Abstract

Background: As the new generation becomes increasingly drawn to technology, using mobile phone applications for education can enhance learning effectiveness.

Objectives: This study aims to design and create mobile-based software to learn about the morphology and physiology of medically important insects. It also investigates user satisfaction with this educational software.

Methods: This applied research was conducted using a developmental method consisting of two stages: designing and creating software for the Android operating system and evaluating the level of satisfaction through an electronic questionnaire administered to 56 biology and disease vector control students. The statistical tests used in this project included the Mann-Whitney test, the Kruskal-Wallis's test, and the independent samples t-test.

Results: There was no significant difference between the genders of the students in their responses to the graphics, educational content, and overall grades. There was also no significant difference between the students' entry year and their responses in the graphic and educational sections or their total scores. Similarly, no significant difference was observed between the age groups of the students in their responses to the graphic test, educational content, and total score (P-value = 0.576, P-value = 0.923).

Conclusion: This software comprehensively covers topics related to the morphology and physiology of medically important insects and disease vectors. It provides information on organism identification and methods of combating them, making it useful for students and researchers.

Keywords: Morphology; Physiology; Software; Mobile Applications

Background

Studying biology and controlling disease vectors are essential for understanding and combating insects that transmit diseases. In Iran, this field has gained considerable attention due to the significance of vectors, highlighting the need to train specialists to address and manage these health threats effectively. This research focuses on key medical insects that carry serious diseases affecting humans. In recent years, the threat of epidemics, such as dengue fever, Zika, and yellow fever, among others, has underscored the necessity for software that enhances our understanding of the morphology and physiology of vectors. This comprehensive software will cover topics related to the morphology and physiology of medically significant insects and disease vectors, aiding students and

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researchers in identifying these organisms and exploring control methods. The COVID-19 pandemic has hindered practical and laboratory instruction across various courses, resulting in increased insect phobias and limited laboratory resources. Unique features of the proposed software include a focus on medically important insects, mobile access, slides and photos of vectors, and assessments of student satisfaction.

We plan to add detailed laboratory courses to our website and application to address these challenges. This interdisciplinary approach, combining biology, disease vector control, and computer engineering, aims to enhance teaching for professors and learning for students while ensuring equitable access to education. If successfully implemented, the initiative will provide professors and students with extensive information on the morphological and physiological traits of important medical insects. The insect morphology and physiology course are a core component of biology and disease vector control programs, where professors and students examine external and internal insect structures. This course includes a laboratory unit facilitating a deeper understanding through practical experiences. In the lab, insects are analyzed more accurately under microscopes and controlled conditions, making hands-on learning essential to this subject. Laboratory experience is crucial for technical and scientific education (1). The development of human societies in various areas, along with the growing demand for new and diverse information, has led to a strong dependence on the flow of timely information. Access to this information is vital in all fields. In this information age, it is natural that the telecommunications and communication technology industries have experienced significant growth. Among these industries, mobile phone services have shown some of the highest growth rates. They are increasingly vital in daily communication and are expected to surpass landline services. Mobile and Internet learning can partly fulfill the idea of learning anytime and anywhere. Mobile learning, a branch of e-learning, allows learners to access educational content more easily than other forms of e-learning. This ease of access is made possible by the extensive communication and interactive features of the devices and tools used in online learning. Learning through mobile phones improves learner satisfaction, encourages autonomy, supports interactive enrichment, and facilitates effective communication activities. Mobile learning, which involves using mobile devices in the teaching and learning process, enables education without time and location limitations, promoting mobility and optimal connectivity. It broadens opportunities for formal and informal education, breaking geographical barriers and accommodating different levels of understanding. Among various mobile learning tools, mobile phones play a key role as a wireless technology transforming education and contributing to the democratization of learning due to their widespread usage. Another emerging educational approach is electronic education (e-learning), which includes a range of software applications and teaching methods based on information technology, such as computers, CDs, networks, the Internet, and intranets. It allows learners to learn anytime and anywhere, tailored to their individual strengths. The idea of virtual laboratories has been proposed to cut costs and simplify laboratory facilities. These virtual labs give students access to real systems (2). This need is particularly important when considering the potential use of virtual laboratories (vLABs) to prepare students for laboratory exercises. These virtual labs can act as an alternative to in-person training, reducing the time and resources needed. Various computer-based technologies are currently being used to enhance training practices. The traditional educational model differs significantly from the hands-on laboratory environment. Research has shown that using educational videos before laboratory exercises effectively standardizes teaching and improves outcomes in later lab work. The main aim of developing a web-based virtual laboratory is to give students access to various science and engineering education experiments through the Internet. This is especially helpful for geographically dispersed students, such as those who study from home. The virtual lab operates on the principles of distance education, allowing students to learn from remote locations without needing to attend the university in person. Within the web-based virtual lab, students can participate in theoretical exercises, access past tests, and review test content. This approach uses programming languages like Java, VRML, and MATLAB (3). However, traditional face-to-face labs come with numerous drawbacks, as supported by extensive studies indicating that these issues are prevalent across various courses and disciplines. We can achieve more comprehensive and effective outcomes by integrating these two teaching methods (3). Since the educational materials will be available online, researchers and interested individuals in Iran and beyond can access the resources and facilities offered by the website and application.

Objectives

Considering the importance of virtual labs in educational science, this study aims to design and

develop mobile-based software for learning about the morphology and physiology of medically important insects. It also investigates user satisfaction with this educational software.

Methods

Study Design and Demographic Characteristics: The present study was a descriptive cross-sectional research project conducted in three stages: assessing software needs, designing and developing the software, and evaluating its effectiveness. The first stage involved designing and creating mobile-based educational software for the morphology and physiology of medically important insects using the Android operating system. The second stage included conducting a questionnaire study to assess user satisfaction and the usefulness of the educational software.

The software development process for this research involves four stages:

1. Designing the basic software template.
2. Gathering data and information related to the morphology and physiology of medically important insects.
3. Entering the collected data into the software.
4. Finalizing the software design and summary.

In the first step, we designed the initial software template and coded the basic Android programming software. For programming, we used Android's internal database, known as the second database. The software overview was created using the Java programming language, and this educational software was developed with Android Studio version 2021.1. To optimize the software production process, the text and images were stored in an SQLite database in Android, which is loaded when the program is executed.

In the second step, we gathered scientific information on the morphology and physiology of medically significant insects from books, websites, and internal and external reference guidelines.

The third step involved entering the collected information into the software's raw format, with the contents of each section entered separately.

In the fourth step, we finalized the software design, which is compatible with the Android system and can be installed on mobile phones for student use. Various software components, including scientific content, images related to insect morphology and physiology, and essential medical arthropods, were selected, modified, and approved by biology and disease vector control experts, who are this study's authors. Due to the small number of undergraduate students, the sample size was calculated through a census. Convenience sampling was used as the sampling method. The data collection tool for this stage was a questionnaire made available to all undergraduate students, laboratory experts with a master's degree, and individuals with a specialized doctorate in biology and disease vector control. A total of 56 participants completed the questionnaire.

Tool Development Phase: The scientific content for the educational software was sourced from reputable scientific publications and specialized books. All the educational images and photos used in the software were obtained from reliable sources, such as the World Health Organization and Google.

A web-ready framework called Joomla (Joomla CMS) was utilized to build a database efficiently and effectively. In this method, the data is registered in the management panel of the web-based software, extracted from the server-side database, undergoes minor modifications, and then prepares the relevant database file for injection into the Android application.

Implementation Phase: After installing the software, users were invited to participate in this study. They were asked to complete an electronic questionnaire carefully, and finally, information related to each user was collected. The software programming team designed and implemented this unique process.

Evaluation Stage: The second stage of this descriptive cross-sectional study was conducted in 2023 with 56 participants, including undergraduate students of biology and disease vector control, laboratory experts, and professors at Kerman University of Medical Sciences. This stage aimed to measure their satisfaction with the software.

The electronic questionnaire used in this study was adapted from Alizadeh et al.'s study conducted in 2018 and 2019 (4-6). In the second data collection stage, the participants completed the electronic questionnaire to measure their level of satisfaction. The questionnaire was specifically designed for this study with some modifications based on Alizadeh et al.'s study on mobile phone-based software for the identification, prevention, and control of head lice and health pest software among biology and vector control students at Jundishapur University of Medical Sciences in Ahvaz (7). The initial study was conducted with the presence of 20 students in the field of biology and disease vector control. Two experts in the field of biology and disease vector control and two experts in the field of statistics confirmed the validity and reliability of the questionnaire. Furthermore, its reliability was confirmed by conducting a preliminary study with a Cronbach's alpha index of 0.85. The questionnaire included demographic

questions such as age, sex, education level, and entry year. It also contained 12 open-ended questions regarding the graphical capabilities of the software, rated on a Likert scale with five options (I completely agree, I agree, I disagree, I completely disagree, I have no opinion). Additionally, there were seven open-ended questions about the educational capabilities of the software, which were also rated on a Likert scale with the same five options.

Data Analysis Method: After the users completed the questionnaires, the data were entered into SPSS software version 27 and analyzed using descriptive statistical indicators. First, the raw data were checked for normality with the Shapiro-Wilk test. An independent sample t-test was used to compare graphic and educational scores in normal data distributions, and the Mann-Whitney test was used to compare non-normal distributions of scores. The Kruskal-Wallis's test was used to compare the scores of different student entries.

Ethical Consideration: Ethical considerations were taken into account, and the participating students were assured that their information would remain completely confidential and that their names and surnames would not be mentioned. The study provided a code for anonymity. This research is part of a project approved by the Student Research Committee affiliated with the Vice-Chancellor of Research and Technology of Kerman University of Medical Sciences in Iran. The grant number for the project is 400000613.

Results

Instrument Characteristics: In this research, a mobile-based educational aid software called "Laboratory of Morphology and Physiology of Medically Important Insects" was developed and designed for mobile phones. The software is compatible with the Android system and can be installed on mobile phones. Appendix 1-A-D displays the final images of the developed software, showing different screens.

The program's logo page opens after clicking on the program icon installed on an Android mobile phone. The top of this page displays the name of Kerman University of Medical Sciences, along with the name of the "Insect Morphology" software (Appendix 1-A). On this page, three options are available: enter the encyclopedia, learn about us, and contact us (Appendix 1-A).

Clicking on the encyclopedia menu on the second page opens three main menus: insect morphology, insect physiology, and medically important arthropods. Selecting the insect morphology menu opens sections on tentacle shapes, different types of legs, mouthparts, and wings in insects.

The corresponding description opens when clicking on each main part of the software. Clicking on the insect physiology menu provides access to menus about the nervous, circulatory, respiratory, digestive, excretory, vision, and reproductive systems. To continue using the software, the 'Medically Important Arthropods' menu should be selected to display a list of these arthropods with their respective images, including spiders, scorpions, and medically important insects. After clicking on each group of medically important arthropods, a page opens. This page includes descriptions of the morphology, biology, and life cycle, as well as the order, family, and different species of that group. An image is also provided next to the species name (Appendix 1-B).

The list of medically important insects includes mosquitoes, gnats, butterflies, blister beetles, Simuliidae, bees, Culicine, Anopheline, myiasis, family Muscidae, Fanniidae, bed bugs, lice, cockroaches, and fleas. After clicking on each of these, a page opens that provides explanations related to morphology, biology, life cycle, and the order, family, and different species of that group. An image is also provided next to the species name (Appendix 1-C, D). Lastly, a page titled 'Contact Us' is presented to receive any criticisms or suggestions from users. Through this page, users can communicate with the creators of the program (Appendix 1-A). The communication methods with the creators include email, WhatsApp, Telegram, and Instagram, managed by the main developer of the software.

Software evaluation results: To evaluate the educational and graphic capabilities of the designed software, 56 students from the first, second, third, and fourth years of biology and vector control, along with experts and professors from the Department of Health at Kerman University of Medical Sciences, participated.

Demographic Information of the Participants: Table 1 lists the results related to the demographic information of the survey participants regarding their degree of satisfaction with the software and shows the demographic information of the software users.

The users suggested adding videos related to the morphology and physiology of insects, using higher quality and higher resolution photos, and creating an installable version of the software. In addition, the software was not installed on mobile phones with Android operating system version 13 or higher for some users due to either the low Android version of their mobile phones or the high version of Android.

Satisfaction of the Students: The survey results on the students' level of satisfaction regarding the graphic and educational capabilities of the contents of the educational software are reported in Table 2.

According to the results of this study, more than 75% of the users mentioned that the software was easy to install. In addition, 85.7% of the users believed that the information provided in the software was up-to-date. This research showed that 98.2% of the users found the software easy to use. The evaluation results regarding the software's educational capabilities in identifying the morphology and physiology of medically important insects are reported in Table 3.

A total of 94.6% of the users believed that the software provided the required information regarding the morphology and physiology of insects. Moreover, 92.9% of the users felt that the designed software enhanced their knowledge, attitude, and performance related to insect physiology and morphology. In addition, 87.5% of the users found the scientific content up-to-date, while 76.8% believed that the software would benefit from including more information that is specialized. Furthermore, 75% of the users preferred using this software to books when seeking information about insect morphology and physiology.

Table 1 presents the demographic information of the survey participants and their level of satisfaction with the software. The results indicated that 80.4% of the participants were female, while 19.6% were male. Regarding age, 12.5% were in the 10-20 years range, while 83.9% were in the 20-30 years range. Furthermore, fourth-year students from this university made up 23.2% of the participants. Among the participants, 94.6% were undergraduates, 3.6% were pursuing a master's degree, and 1.8% held a PhD.

Refer to Table 1 for a comprehensive overview of the demographic information.

The users provided suggestions for enhancing the software, including adding videos on insect morphology and physiology, using higher quality and resolution photos, and developing an installable version. Some users also reported issues with installing the software on Android phones with version 13 or higher, which could be attributed to either their phone's lower Android version or the software's compatibility with higher Android versions. Table 2 presents the survey results regarding students' satisfaction with the graphic and educational capabilities of the software content. According to the findings, over 75% of the users found the software installation process easy. Additionally, 85.7% of the users expressed that the information provided in the software was up-to-date. Furthermore, the research revealed that 98.2% of the users actively utilized the software. A detailed overview of the users' satisfaction levels is provided in Table 2.

Table 3 reports the evaluation results of the software's educational capabilities in identifying the morphology and physiology of medically important insects. The findings indicated that 94.6% of the users believed the software adequately provided the required information on insect morphology and physiology. Moreover, 92.9% of the users reported that the software improved their knowledge, attitude, and performance about insect physiology and morphology. Regarding the scientific content, 87.5% of the users found it to be up-to-date. However, 76.8% of the users desired more specialized information within the software's content. Additionally, 75% of the users preferred using the software to books when seeking information on insect morphology and physiology.

Table 4 shows the students' satisfaction scores for the graphic and educational capabilities and the total score of the students' answers to the questionnaire items. The Mann-Whitney statistical test indicated no significant difference between the genders of the students and their graphic, educational, and overall grades (Table 5). The Kruskal-Wallis statistical test showed no significant difference between the students' entry year and their responses in the graphic and educational sections or their total score (Table 5). Furthermore, the independent samples t-test showed no significant difference between the age groups of the students and their responses in the graphic test (Table 5). The Mann-Whitney statistical test also showed no significant difference between the age groups of the students and their responses in the educational section or their total score ($P = 0.576$, $P = 0.923$) (Table 5).

Discussion

The software developed in this study aims to teach biology students about disease vectors and their control.

Comprehensive software includes materials and photos related to the morphology and physiology of medically important insects. This software is designed to help students and researchers identify these organisms and learn about methods of combating them. It is mobile-based software, the first of its kind developed in Iran that assists students and laboratory experts in understanding and examining the morphological and physiological characteristics of medically important insects. The results of this study demonstrated that using educational software positively affected the students' learning. Accordingly, 92.85% of the students reported that the information provided by this educational

software increased their knowledge, attitude, and performance, as well as that of other users. In recent years, health and medical care have significantly grown with the help of mobile phone technology and software. This is because it is affordable and accessible for all users. For example, programs available for dental and oral health care can be accessed through mobile phones. Additionally, virtual training programs are specifically designed to help pregnant mothers with childbirth preparation (8-10). This study aims to develop and assess a comprehensive educational software application called Najbam, specifically designed for environmental health engineering students. This smartphone-based software aims to teach the proper techniques for disinfecting fruits and vegetables. By implementing and utilizing this software, we can enhance environmental health engineering students' educational experience and knowledge (11). In 2009, Wolf and colleagues conducted a study to evaluate the effectiveness of virtual laboratories for student learning (1). It is important to determine whether these virtual labs continue to impact student learning positively. The study's author assessed a computer-networking course to measure the learning that occurs during both lectures and lab sessions. The results showed that students learned during lab sessions, but a significant amount of learning (45.9%) also occurred during lectures, accounting for 54.1%. Notably, even students with previous experience in networking benefit from participating in virtual labs (1). In 2007, Wang discussed different technologies related to virtual laboratories and presented the technical structure and some project outcomes (3). The topic of virtual labs in science education has become increasingly important due to the rising costs of hands-on laboratories and the expansion of distance learning. Recent studies have examined how virtual tools can complement traditional lab experiences rather than replacements. Hawkins et al. (2013) conducted a study to evaluate the effects of virtual lab methods and ensure the effectiveness of conventional approaches. They compared a virtual lab scenario with a practical one in an electrochemistry class involving general chemistry students. Half of the students participated in the traditional lab format, while the other half used a virtual lab animation provided by the Iowa State Department of Education. The researchers collected pre-test and post-test data to measure the students' conceptual understanding and practical skills in setting up an electrochemical cell. The results showed no significant differences in scores between the two groups on the pre-test, post-test, or practical adjustment test. However, a notable difference emerged in specific test items, particularly concerning using the salt bridge during the post-test and practical setup (12). In their review of research on school science laboratories that employ simulation technology, Wang et al. (2014) found that simulations were often utilized as a precursor to physical lab work. Simulations enhance their learning and performance by introducing students to basic concepts and principles before they enter the physical labs. These simulations support students' understanding and boost their motivation to learn and improve their competence in self-assessment (13). Similarly, Wheeler (2012) noted an increase in students' perceived competence in the subject matter following a simulation-based training workshop, with students rating the workshop highly (2). In a literature review, Smetana and Bell (2012) concluded that, depending on their application, simulations could be as effective, if not more so, than traditional teaching methods. Simulations are recommended as supplementary tools alongside other educational methods (14). In 2020, Alizadeh et al. developed a mobile-based educational software to identify key health pests. The study showed that using this software positively affected student learning, with over 90% of students reporting enhanced knowledge, attitudes, and performance as a result (4). In 2019, Alizadeh et al. developed a specialized mobile application focused on bed bugs, one of the common health pests (5). The results of their study showed that user satisfaction with the bed bug mobile software was over 80% (5). Users also reported that the educational and practical information provided by the software had a positive impact, with over 78% acknowledging its usefulness (5). In 2020, Alizadeh et al. developed the first mobile-based software in Iran for identifying, preventing, and controlling sanitary pests (4). The study's findings revealed that the use of this educational software had a positive impact on students' learning. Over 90% of students reported that the software's information increased their knowledge, attitude, and performance, as well as that of other users (4). In a 2014 study by Ghazi-Saeedi and colleagues, over 82% of caregivers of children with cerebral palsy expressed satisfaction with the software developed in the study, stating that it met their information needs (15). Our study findings align with these results. In 2018-2019, Alizadeh et al. developed a mobile phone-based software for identifying, preventing, and controlling head lice. The study investigated the level of satisfaction among users of this educational software. The study's results showed that users of the mobile phone-based software

were highly satisfied. Over 60% of users found the information helpful in addressing head lice infestation (7). Additionally, more than 95% of users understood the scientific content of the software and considered it up-to-date (7). Most users (78%) reported that the educational information in the software effectively prevented and controlled lice infestation. Furthermore, approximately 81% of users preferred using this software instead of studying specialized texts during head lice infestation. They also reported a high level of effectiveness in controlling head lice through the educational information provided by the software (7). These findings are consistent with the present study. Safdari et al.'s study in 2017 also found that users of a developed software application for tuberculosis were satisfied, aligning with the results of the present study (16). Nasiri et al.'s study in 2013 investigated the effect of teaching anatomy through cell phones compared to lectures (17). The results indicated that teaching via cell phones improved learning and memory among medical students, with a particular emphasis on memorization (17). The present study found a preference for mobile phone-based education over traditional texts. Several other studies, including those by Nazari et al. in 2018 (18), Habibzadeh et al. in 2013 (19), and Papzan et al. (20), have reported similar results. Sarani and Ayati's study in 2013 (21) demonstrated high student satisfaction in learning English through mobile phones and combining this method with other educational approaches. Students also expressed high satisfaction in learning specialized subjects through mobile apps. Afkhami Aghda et al.'s study in 2013 (22) highlighted the significant impact of information and communication technology, including mobile apps, on education and social relations.

The images used in this mobile application adhere to Islamic norms. Additionally, the application includes content sourced from reputable books and authoritative references. By using this software, students can gain a thorough understanding of the morphology and physiology of significant insects in medicine. They can also virtually familiarize themselves with the laboratory unit of their course. Furthermore, since the application is designed to be presented as a website, interested individuals and researchers within and outside Iran can access the resources and facilities offered by this website and application. The limitations of the software include its size when installed on a mobile phone, the selection of scientific materials related to insect morphology and physiology, the collection of insect photos, the Preparation of photos featuring dried insect samples, and the preparation of photos of insect slides. We also faced limitations related to small sample sizes and convenience sampling. It is suggested that the software be developed into a more comprehensive and improved website, which can be made accessible to students of other medical science universities.

Conclusion

The present study found that the students were satisfied with the mobile app as a form of mass communication. Overall, the findings of this study and previous research demonstrate the positive reception and effectiveness of mobile phone-based educational software in various fields.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The current research has the ethics approval code number IR.KMU.REC.1400.568. In this study, the users, including students and expert colleagues of the laboratory, voluntarily participated after receiving the necessary explanations about the study and its objectives and after being assured of the confidentiality of their information.

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References

1. Wolf T. Assessing Student Learning in a Virtual Laboratory Environment. IEEE Transactions on Education. 2010; 53(2): 216-22. doi: 10.1109/TE.2008.2012114.
2. Wheeler S. Digital literacies for engagement in emerging online cultures. eLearn Center Research Paper Series. 2012; 5:14-25.
3. Li L, Wang H. A New Method for Building Web-based Virtual Laboratory. Proceedings of the First IEEE International Symposium on Information Technologies and Applications in Education; 2007 Nov 23-25; Kunming, China. 2007: 555-8. doi: 10.1109/ISITAE.2007.4409347.
4. Alizadeh I, Jahanifard E, Sharififard M. Design and Evaluation of Educational Software of Importance Health Pests based on Mobile

to Increase Knowledge of Medical Sciences Students. Educational Development of Judishapur. 2020; 11(3): 360-71. doi: 10.22118/edc.2020.221026.1276. [In Persian]
5. Alizadeh I, Gorouhi MA, Aghaei Afshar A, Hyati R, Mirr I. Satisfaction of Mobile Users with mobile Application "Identification, Prevention, and Control of Bed Bugs": Designing and Developing Mobile Health Application. Journal of Health and Biomedical Informatics. 2019; 6(1): 24-31. [In Persian]
6. Alizadeh I, Gorouhi MA, Afshar AA, Iranpour A. The Social Impacts of Bedbug Infestation as an Emerging Public Health Issue: A Case Report. Electronic Physician. 2019; 11(4): 7636-42. doi: 10.19082/7636.
7. Alizadeh I, Gorouhi MA, Aghaei Afshar A, Mirr I. Design and Development of a Mobile-Based Application for Identification, Prevention, and Control of Head Lice and Survey of User Satisfaction. Journal of Health and Biomedical Informatics. 2021; 7(4): 425-34. [In Persian]
8. Tajvar M, Asgari Faryadras N, Atashbahar O, Ashoorkhani M, Yaseri M. Investigating the effect of virtual childbirth preparation education on the health practices of pregnant women: a quasiexperimental study. Iran J Health Educ Health Promot. 2023; 11 (3) :302-18. doi: 10.22034/11.3.302. [In Persian]
9. Navabi Z S, Ahmadi A, Sabri M R. Design and Evaluation of a Mobile Phone-based Oral Health Educational Application for Children and Adolescents with Congenital Heart Defects. Iran J Health Educ Health Promot 2023; 11 (4):434-64. doi: 10.22034/11.4.434. [In Persian]
10. Kauw D, Koole M, VanDorth JR, Tulevski II, Somsen GA, Schijven MP, et al. eHealth in patients with congenital heart disease: a review. Expert Rev Cardiovasc Ther. 2018 Sep;16(9):627-634. doi: 10.1080/14779072.2018.1508343. [PMID: 30079780]
11. AliZadeh I, Mohammadi A, Faraji M. Designing and Assessment of Disinfection of Vegetables and Fruits Educational Software based on Smartphone for Environmental Health Engineering Students, Kerman University of Medical Sciences. The Journal of Toloo-e-behdasht; 2021; 20(2): 63-74. doi: 10.18502/tbj.v20i2.6766. [In Persian]
12. Hawkins I, Phelps Amy J. Virtual laboratory *vs.* traditional laboratory: which is more effective for teaching electrochemistry? Chemistry Education Research and Practice. 2013; 14(4): 516-23. doi: 10.1039/C3RP00070B.
13. Wang CY, Wu HK, Lee Silvia WY, Hwang F-K, Chang HY, Wu YT, et al. A Review of Research on Technology-Assisted School Science Laboratories. Educational Technology & Society. 2014; 17(2): 307–20.
14. Smetana LK, Bell RL. Computer Simulations to Support Science Instruction and Learning: A critical review of the literature. International Journal of Science Education. 2012;34(9): 1337-70. doi: 10.1080/09500693.2011.605182.
15. Ghazisaeedi M, Sheikhtaheri A, Dalvand H, Safari A. Design and evaluation of an applied educational smartphone-based program for caregivers of children with cerebral palsy. Journal of Clinical Research in Paramedical Sciences. 2015; 4(2): 128-39. [In Persian]
16. Safdari R, Hasan Nejadasl H, Rostam Niakan Kalhori S, Nikmanesh B. Design and evaluation of mobile-based self-management system for tuberculosis. Journal of Payavard Salamat. 2018; 12(3):230-8. [In Persian]
17. Nasiri M, Nasiri M, Adarvishi S, Hadigol T. The effectiveness of teaching anatomy by mobile phone compared with its teaching by lecture. Journal of Medical Education Development. 2014; 7(14):94-103. [In Persian]
18. Nazari Kamal M, Samouei R, Sarafzade S, Ghaebi N, Moradi F, Moradzadeh M. The effect of education via mobile phones on procrastination of Iranian users: designing a treatment aid application. Journal of Health and Biomedical Informatics. 2018; 5(2):286-92. [In Persian]
19. Habibzadeh M, Gazarani A, Sadeghi R, Mahzoun A. Investigating the effect of using surgical instruments software in facilitating training rooms for operating room students. Proceedings of the First National Conference on Methods of Teaching and Learning in the Area and University; 2014; May 20-21; Bojnurd, Iran. 2014. [In Persian]
20. Papzan AH, Soleymani A. Comparing cell phone-based and traditional lecture-based teaching methods effects on agricultural students learning. Information and Communication Technology in Educational Sciences. 2010; 1(1):55-65. [In Persian]
21. Sarani H, Aayati M. The Impact of Mobile Phone Using (SMS) On Learning English Vocabulary and The Students' Attitude. Curriculum Planning Knowledge & Research in Educational Sciences. 2014; 11(13): 48-60. [In Persian]
22. Afkhami Aqda M, Kamali Zarch M, Shokorawa N. The effect of information and communication technology (ICT) on the education process from the perspective of Yazd University students. Tolooebehdasht Journal. 2012; 11(1): 41-52. [In Persian]

Table 1. The Demographic Information of Software Users from Kerman University of Medical Sciences in 2023

Demographic information	Number (percentage)
Gender	
Male	11(19.6)
Female	45(80.4)
Age group	
10-20	7(12.5)
20-30	47(83.9)
30-40	1(1.8)
40-50	1(1.8)
Education level	
Bachelor of sciences (BSc)	53(94.6)
Masters (MSc)	2(3.6)
PhD	1(1.8)

Table 2. Evaluation Responses on the Software's Graphical Capabilities in Identifying the Morphology and Physiology of Medically Important Insects at Kerman University of Medical Sciences in 2023

Questions	I totally agree	I agree	I disagree	I totally disagree	I have no opinion
	Number (percentage)				
Installing the mobile phone is a straightforward process.	26(46.4)	25(44.6)	3(5.4)	1(1.8)	1(1.8)
The software's memory usage is optimized for the phone's storage capacity.	23(41.1)	29(51.8)	2(3.6)	0	2(3.6)
The software is user-friendly.	33(58.9)	22(39.3)	1(1.8)	0	0
The graphic components, buttons, and colors used in the software is appropriate.	14(25)	34(60.7)	6(10.7)	1(1.8)	1(1.8)
The software's graphic components, buttons, and colors are well chosen.	26(46.4)	26(46.4)	3(5.4)	0	1(1.8)
Can the designed software allow users to navigate to the next or previous pages?	22(39.3)	28(50)	4(7.1)	0	2(3.6)
The software's pages and image quality are designed with clarity and transparency.	20(35.7)	33(58.9)	1(1.8)	0	2(3.6)
The fonts utilized in the software are suitable and easy to read.	25(44.6)	28(50)	1(1.8)	0	2(3.6)
The software information is categorized appropriately.	13(23.2)	26(46.4)	5(8.9)	3(5.4)	9(16.1)
Receiving user comments through the communication channels defined in the software is a straightforward process.	23(41.1)	25(44.6)	0	0	8(14.3)
Is the amount of internet consumption by the software appropriate when it is being used?	18(32.1)	30(53.6)	5(8.9)	0	3(5.4)
Was the information provided in the software up-to-date?	15(26.8)	27(48.2)	4(7.1)	2(3.6)	8(14.3)
Was it easy to communicate with the software developers?	38.38	49.54	5.20	1.05	5.83
Overall results (%)	26(46.4)	25(44.6)	3(5.4)	1(1.8)	1(1.8)

Table 3. Evaluation Responses Regarding the Educational Capabilities of the Software in Identifying the Morphology and Physiology of Medically Important Insects at Kerman University of Medical Sciences in 2023

Questions	I totally agree	I agree	I disagree	I totally disagree	I have no opinion
	Number (percentage)				
The software effectively caters to users' information needs regarding the morphology and physiology of insects.	28(50)	25(44.6)	2(3.6)	0	1(1.8)
Learning the material becomes easier with different images.	27(48.2)	22(39.3)	3(5.4)	1(1.8)	3(5.4)
The use of software enhances the ease of both learning and teaching.	24(42.9)	29(51.8)	1(1.8)	0	2(3.6)
The software that has been designed enhances users' knowledge, attitude, and performance regarding the physiology and morphology of insects.	24(42.9)	28 (50)	3(5.4)	0	1(1.8)
The software's scientific content is current.	22(39.3)	27(48.2)	2(3.46)	0	5(8.9)
The software needs to incorporate a greater amount of specialized information in its content.	13(23.2)	30(53.6)	3(5.4)	0	10(17.9)
When I need information on insect morphology and physiology, I prefer using this software to a book.	13(23.2)	29(51.8)	6(10.7)	3(5.4)	5(8.9)
Overall results (%)	38.52	48.47	5.10	1.02	6.9

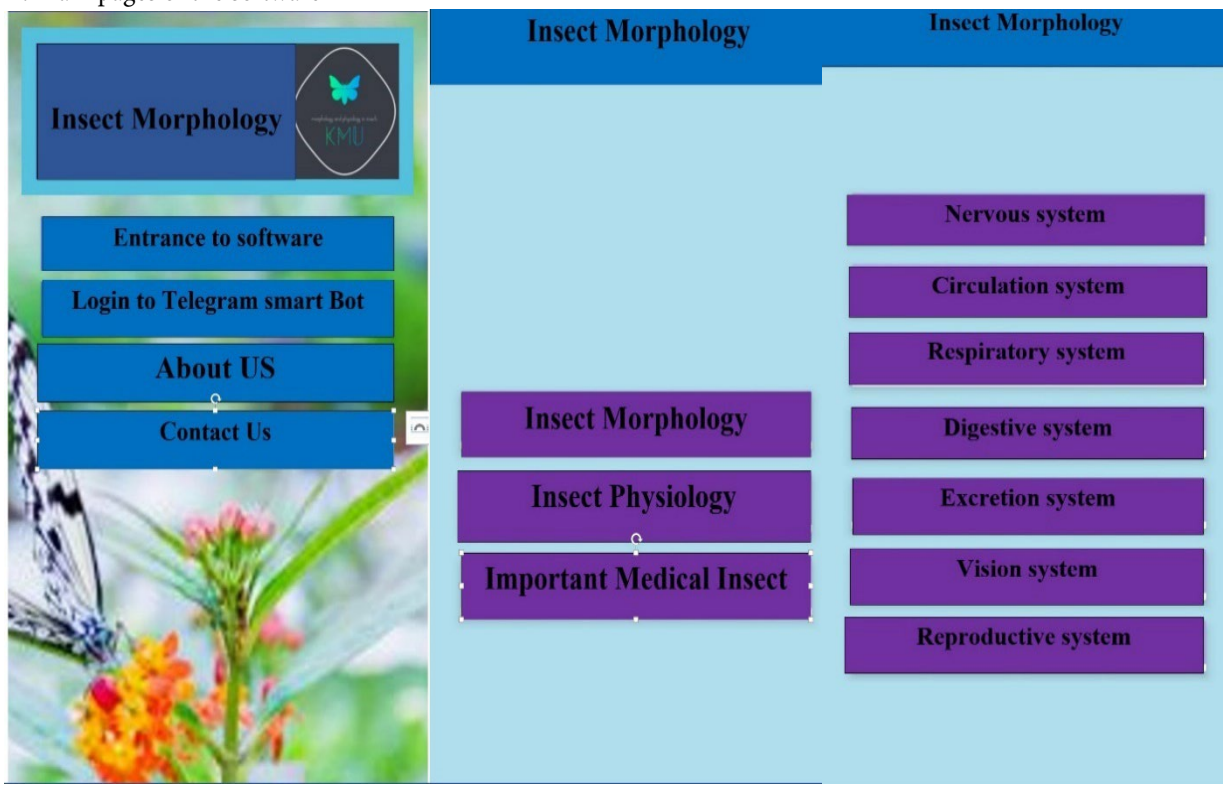
Table 4. Comparing the Results of Assessing the Graphic and Educational Features of the Software Studied Within the Target Group

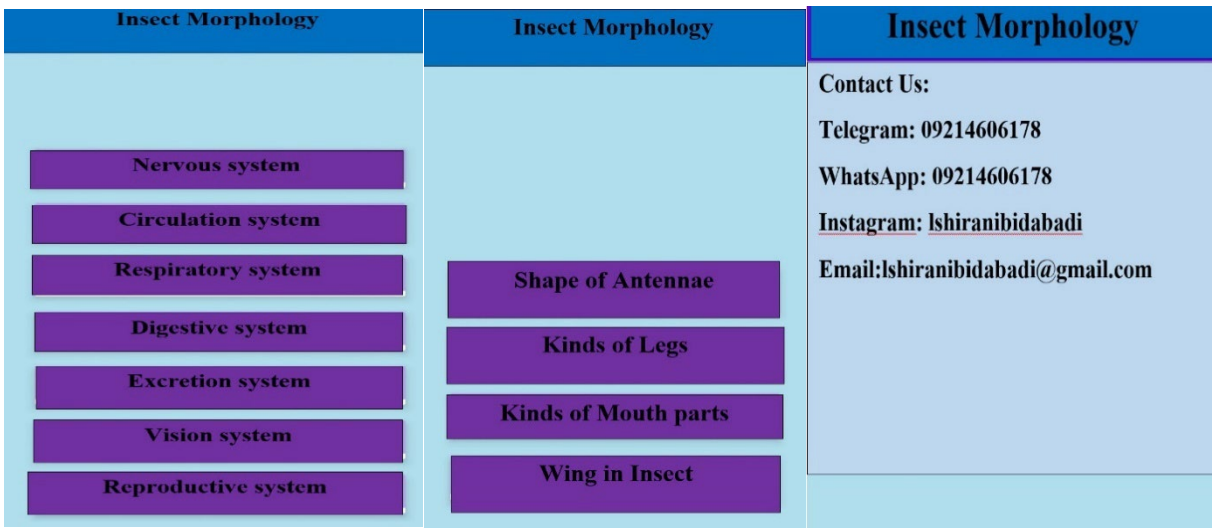
Score	Mean	Standard Deviation	Median	Percentile 25	Percentile 75
Total. Score	79.57	8.25	79.00	76.00	85.00
Train. Score	29.29	3.88	29.50	28.00	32.00
Graphic. Score	50.29	5.14	50.00	48.00	54.50

Table 5. Investigating the Impact of Demographic Factors on Students' Graphic and Educational Capabilities with the Software

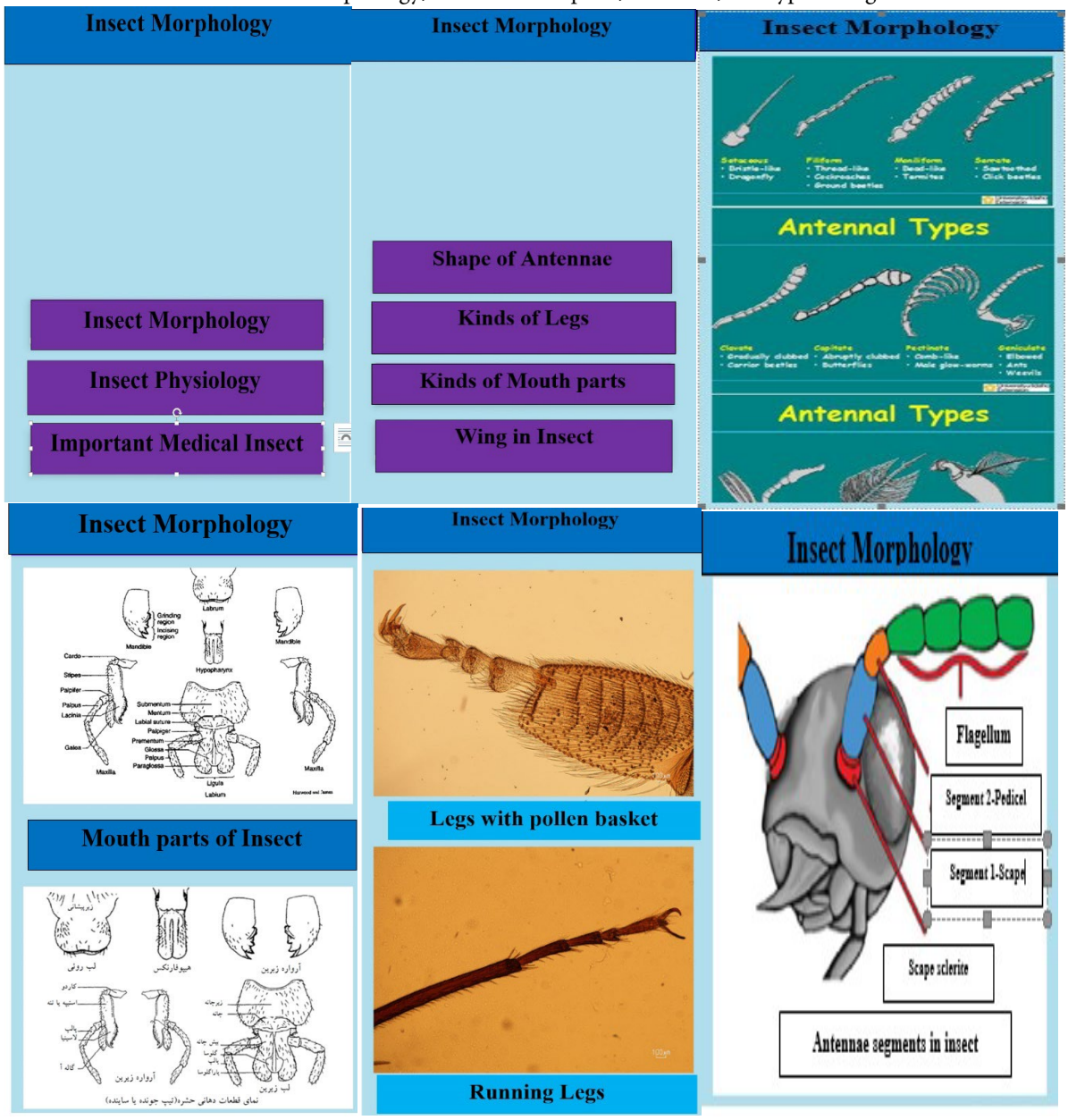
			Mean	Standard Deviation	Median	Percentile 25	Percentile 75	P-value
Total. Score	Sex	Female	79.71	8.11	79.00	76.00	85.00	0.901
		Male	79.00	9.19	79.00	73.00	85.00	
Train. Score	Sex	Female	29.51	3.85	30.00	28.00	32.00	0.333
		Male	28.36	4.06	28.00	24.00	32.00	
Graphic. Score	Sex	Female	50.20	5.06	49.00	48.00	54.00	0.605
		Male	50.64	5.70	50.00	49.00	57.00	
Total. Score	Age 1	10-20	80.43	4.35	80.00	77.00	84.00	0.923
		20-40	79.45	8.69	79.00	76.00	85.00	
Train. Score	Age 1	10-20	30.14	2.04	29.00	29.00	33.00	0.576
		20-40	29.16	4.07	30.00	28.00	32.00	
Graphic. Score	Age 1	10-20	50.29	3.30	48.00	48.00	54.00	0.319
		20-40	50.29	5.38	50.00	48.00	55.00	
Total. Score	Entrance	1399	81.38	7.82	84.00	79.00	87.00	0.204
		1400	81.33	6.54	77.00	76.00	87.00	
		1401	75.19	11.01	77.00	70.00	83.50	
		1402	81.27	4.54	80.00	77.00	85.00	
Train. Score	Entrance	1399	30.38	3.38	31.00	30.00	32.00	0.219
		1400	29.75	2.38	28.00	28.00	31.50	
		1401	27.31	5.64	28.00	22.50	32.50	
		1402	30.07	2.09	29.00	28.00	32.00	
Graphic. Score	Entrance	1399	51.00	5.20	52.00	46.00	55.00	0.391
		1400	51.58	4.23	49.00	48.00	55.50	
		1401	47.88	6.70	49.00	43.00	51.50	
		1402	51.20	3.00	51.00	48.00	54.00	

A. Main pages of the software

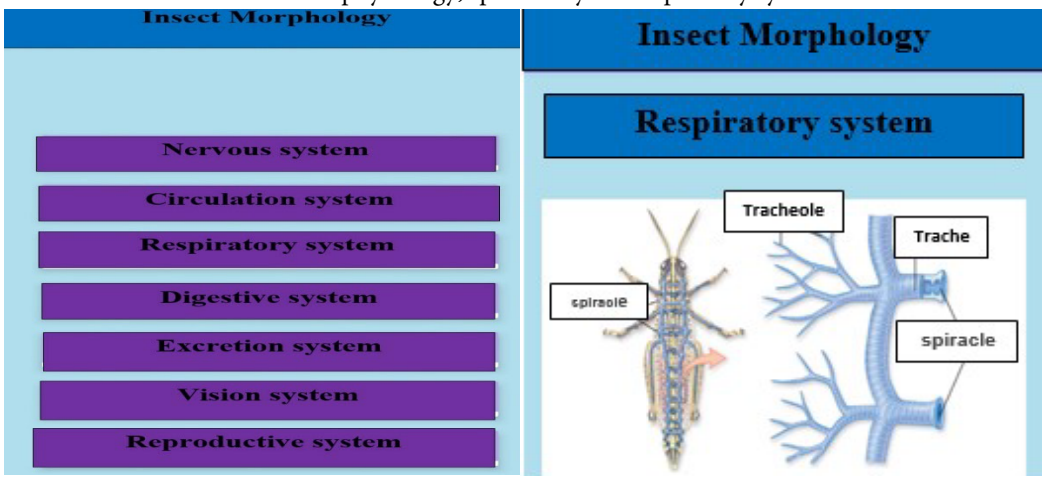




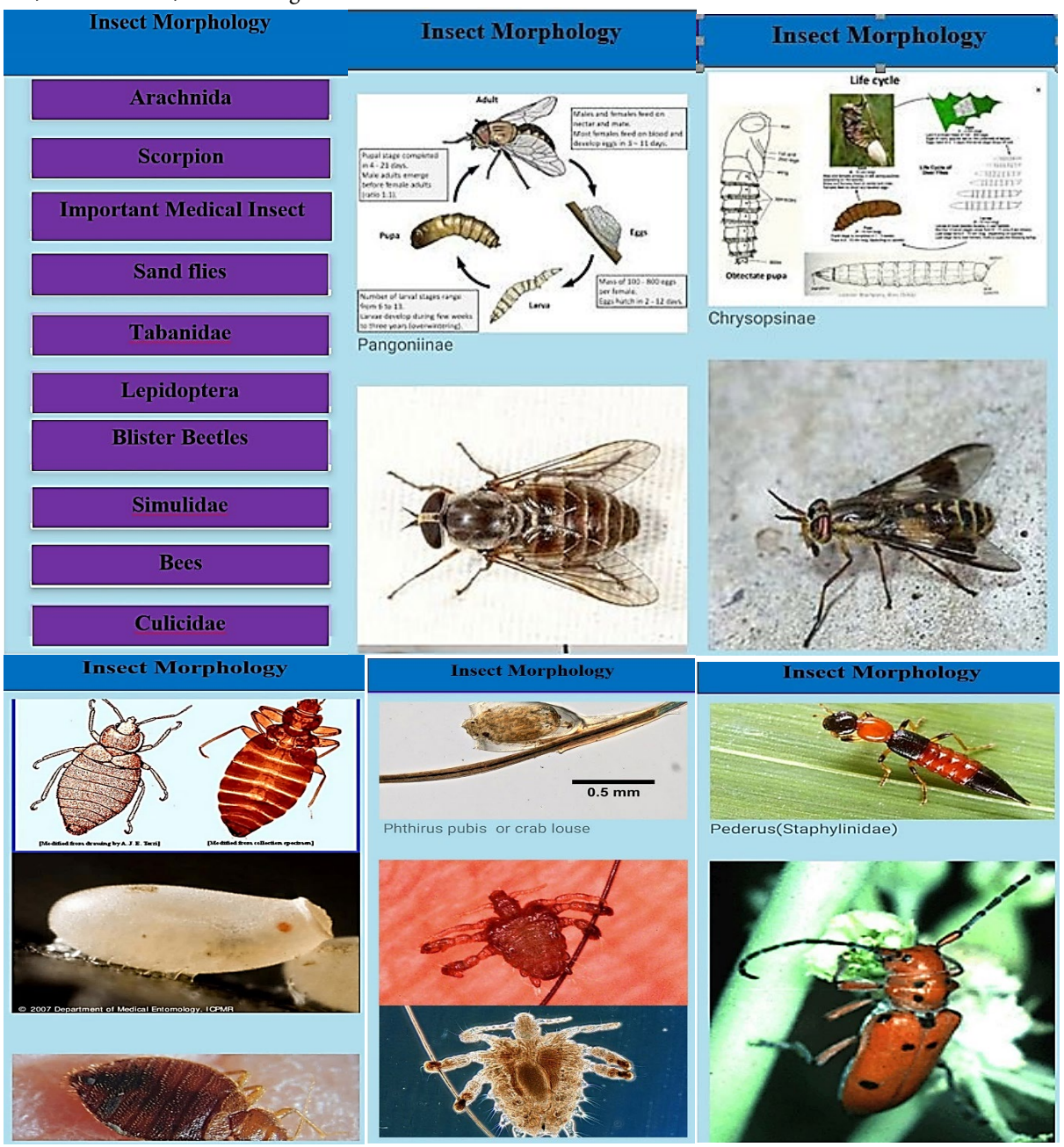
B. Subsections related to insect morphology, such as mouthparts, antennae, and types of legs



C. Subsections related to insect physiology, specifically the respiratory system



D. Subsections related to each group of medically important arthropods presented in the software, including Tabanidae, lice, blister beetles, and bed bugs



Appendix 1. A view of the main pages of the software created in this study