

STRIDES in DEVELOPMENT of MEDICAL EDUCATION



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Psychometric Properties of the Persian Version of the Online Learning Readiness Scale

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Abstract

Background: The rapid growth of information technology has created opportunities for online learning.

Objectives: The aim of this study was to investigate the psychometric properties of the Persian version of the Online Learning Readiness Scale (OLRS) and assess the readiness of health care providers in this regard.

Methods: This cross-sectional study was conducted in 2022 among 181 health care providers in Kerman, selected through multi-stage sampling. The data collection tool included a questionnaire with demographic information and the Persian version of OLRS, comprising 18 questions across 5 subscales: computer/internet self-efficacy, self-directed learning, learner control, learning motivation, and online communication self-efficacy. Data were analyzed using Pearson correlation, independent *t*-test, and analysis of variance (ANOVA) in SPSS v. 26, as well as LISREL v. 8.8 software.

Results: Cronbach's alpha coefficient for subscales ranged from 0.74 to 0.93, with factor loadings of items ranging from 0.54 to 0.96. Goodness-of-fit indices met acceptable standards. The mean scores for all subscales exceeded the average (2.5). Health care providers in rural areas had higher mean scores in the self-directed learning ($P=0.04$), learning control ($P=0.02$), and learning motivation ($P=0.001$) subscales. Men scored higher in the self-directed learning ($P=0.01$) and learning motivation ($P=0.04$) subscales.

Conclusion: The Persian version of OLRS demonstrates satisfactory psychometric properties and can be used to assess the readiness of learners for online learning. When planning such training, it is crucial to consider factors related to learners' readiness, including demographic and occupational characteristics.

Keywords: Online Learning, Online Learning Readiness, Health Workers, Psychometric Properties, Iran

Background

In recent years, virtual education has offered numerous opportunities to enhance the educational experience through the utilization of advanced technologies. The incorporation of technology into education and the emergence of virtual education have been global phenomena since 1985. Over the years, various generations of virtual education have evolved, with a pivotal moment occurring in 1995 when advancements in computer technology and telecommunication network bandwidth paved the way for webinars. This technological progress enabled the creation of high-quality web-based audio and video content, marking the

advent of the fourth generation of virtual education. Digital technology, particularly web-based tools, has continued to evolve, encompassing a more comprehensive array of learning experiences and training opportunities. With the motto of "education accessible anytime, anywhere," virtual education has made significant strides, becoming a cornerstone of modern education (1).

Iran's educational system underwent notable transformations in parallel with the rest of the world. Virtual education was prioritized and embraced by the educational system, especially in response to the COVID-19 pandemic. Schools and universities adopted

the slogan, "Schools and universities are closed, but education remains open." Consequently, the pandemic and the widespread adoption of virtual education can be seen as a pivotal moment in Iran's educational landscape (2). Numerous studies have highlighted the advantages and capabilities of virtual education, emphasizing features such as direct digital learning and communication, learner-centered approaches, flexibility, innovative teaching methods, reproducibility, and error correction. These factors have contributed to the appeal and effectiveness of virtual education (3).

Presently, the advancement of telecommunication networks and the enhancement of hardware systems, including smartphones and laptops, have facilitated participation in major international scientific events from even the remotest villages. Medical universities must adapt to these developments and evolve their educational management systems to cater to diverse learners and health care providers (4). In Iran, a substantial portion of health care services is provided by community health service providers, known as *behvarz*, who operate in health houses in rural regions. They are considered the front line of health care delivery, particularly in underserved and rural areas, making them a vital component of the country's health care system (5).

Given the geographical dispersion of health posts and health houses across the country, conducting in-person continuing education programs entails significant time and financial resources. Therefore, following the experience of the COVID-19 pandemic and with the establishment of suitable virtual education infrastructure in the country, virtual education can serve as an efficient means for the ongoing training of health care providers at the primary level.

Objectives

This study aimed to assess the psychometric properties of the Persian version of the Online Learning Readiness Scale (OLRS) and evaluate the readiness for online learning and its associated factors among health care providers working in health centers affiliated with the Kerman Health Center in 2022.

Methods

This study employed a descriptive-analytic cross-sectional design. The target population encompassed all health care providers employed in health centers affiliated with the Kerman Health Center in 2022. A total of 180 participants were selected using a multi-stage sampling approach. Given that one of the study's

objectives was to assess the psychometric properties of the Persian version of the OLRS, the sample size was determined to be 10 times the number of items in the questionnaire (6, 7). Consequently, a final sample of 181 individuals participated in the study.

Inclusion criteria comprised health care providers working within the health centers affiliated with the Kerman Health Center during the study period and their willingness to partake in the research. Exclusion criteria included the intention to change workplaces or retire within the next 6 months and questionnaires with more than 10% unanswered questions.

The data collection instrument consisted of a 2-part self-administered questionnaire. It encompassed demographic characteristics and the Persian version of the OLRS, originally developed in 2010 by Min-Ling Hung et al. The OLRS comprised 18 items categorized into 5 subscales: self-directed learning (5 items), learner control (3 items), learning motivation (4 items), computer/internet self-efficacy (3 items), and self-efficacy of online communication (3 items). The original version employed a 5-choice Likert scale ranging from "completely disagree" (1) to "completely agree" (5). Subscale scores were obtained by summing the scores of the respective items and dividing by the number of items. The minimum and maximum scores for each subscale were 1 and 5, respectively.

For the preparation of the Persian version, the translation-retranslation method was utilized following permission from the original designers. Its reliability was evaluated through Cronbach's alpha and the corrected item-total correlation in a pilot study involving 30 health care providers, who later became part of the main analysis. Since this study employed a translated questionnaire, some experts argue that there is no need to reassess content validity, as it has already been validated in the original version (6). The face validity of the questionnaire was qualitatively confirmed by a panel of experts consisting of 5 medical education specialists. Construct validity was assessed using confirmatory factor analysis.

The researcher distributed 200 questionnaires in selected centers, with 181 questionnaires ultimately completed by the participants. Questionnaires were submitted anonymously, and oral consent was obtained. The time required for questionnaire completion averaged 10 minutes. Data were collected and analyzed using SPSS v. 26 (IBM Corp., Armonk, NY, USA). Qualitative variables were described using frequency and percentage indices, while quantitative variables

were summarized using mean and standard deviation. The analysis employed Pearson correlation, independent *t*-test, and one-way analysis of variance (ANOVA). The significance level was set at less than 0.05. Confirmatory factor analysis was conducted using LISREL v. 8.8 (Scientific Software International, Inc. USA), along with the assessment of model fit using goodness-of-fit indices. The study received approval from the Ethics Committee of Kerman University of Medical Sciences with the code IRKMUREC.1401.200.

Results

The study included a total of 181 health care providers, with a mean age of 35.65 ± 7.97 years and a predominance of females (87.8%). Table 1 presents the participants' characteristics.

The mean score of the subscales was 3.78 ± 0.95 , 3.35 ± 0.85 , 3.33 ± 0.94 , 3.64 ± 0.99 , and 3.73 ± 0.99 for computer/internet self-efficacy, self-directed learning, learner control, motivation for learning, and online communication self-efficacy, respectively. Among the online learning readiness subscales, computer and internet self-efficacy had the highest mean score at 3.78, followed closely by online communication self-efficacy with an average of 3.73. The lowest average, 3.33, was observed for the learner control subscale.

Table 2 displays the factor loadings, *t*-test results, and Cronbach's alpha values for the subscales of the Persian version of the OLRs. The internal consistency, as indicated by Cronbach's alpha, ranged from 0.74 to 0.93 for subscales. The overall scale showed a Cronbach's alpha coefficient of 0.95. Moreover, the corrected item-total correlation demonstrated that all items had coefficients exceeding 0.4, underscoring the instrument's strong reliability. Examining Table 2, the factor loadings of the items fell within the range of 0.54 to 0.96, with none of the items warranting removal in the Persian version. Additionally, considering that all *t*-values exceeded 1.96, it suggests that the observed correlations are statistically significant (Table 3).

Table 1. Characteristics of the health care providers

Variables	Categories	Health care workers in urban areas	Health care workers in rural areas
Gender N (%)	Female	125(95.4)	34(68.0)
	Male	6(4.6)	16(32.0)
Experience of virtual education N (%)	Yes	110(84.0)	40(80.0)
	No	21(16.0)	10(20.0)
Educational level N (%)	Diploma	4(3.1)	46(92.0)
	Associate degree	43(32.7)	2(4.0)
	Bachelor's degree and above	84(64.2)	2(4.0)
Age Mean (SD)		34.60(7.54)	38.40(8.46)
Working experience Mean (SD)		9.43(7.78)	15.70(9.17)

In the confirmatory factor analysis, the majority of the goodness-of-fit indices met acceptable standards (Table 3).

Table 4 illustrates the mean scores of the subscales of online learning readiness and their comparison based on the participants' characteristics. Accordingly, the mean scores of all online learning readiness subscales were higher among health care workers in rural areas compared to their urban counterparts. However, statistically significant differences were found in the mean scores of self-directed learning, learner control, and learning motivation, while the mean scores of computer/internet self-efficacy and online communication self-efficacy did not exhibit statistically significant differences.

Furthermore, men had higher mean scores than women in all online learning readiness subscales. However, the mean scores of computer/internet self-efficacy, learner control, and self-efficacy of online communication in both men and women did not show statistically significant differences. Notably, the self-directed learning and learning motivation subscales had significantly higher mean scores among men than women.

Also, the mean score of online learning readiness subscales had no statistically significant difference based on online education experience. In subjects with diploma, the mean score of the learner control and learning motivation was significantly higher than those with bachelor's degree and above. The mean score of computer/internet self-efficacy, self-directed learning and online communication self-efficacy subscales did not show statistically significant differences based on education level.

Moreover, there was a significant inverse correlation between the participants' mean age and the mean score of computer/Internet self-efficacy ($r = -0.16$, $P = 0.03$) and online communication self-efficacy ($r = -0.17$, $P = 0.02$). This suggests that as participants' age increased, the mean scores of these subscales decreased.

Table 2. Factor loadings, T-values of the items and Cronbach's alpha of the subscales of the Persian version of the Online Learning Readiness Scale

Subscales	Factor loadings	T value	Cronbach's alpha
Computer/internet self-efficacy			0.74
Being confident in doing the programs like PowerPoint, Word and Excel	0.66	9.46	
Being confident about my knowledge and skills to manage computers and the Internet for online learning	0.87	13.82	
Being confident in finding the necessary information through Internet	0.80	12.19	
Self-directed learning			0.87
Design my study plan for online learning	0.68	10.14	
Get help from others when facing problems	0.62	8.88	
Manage my time well during online learning	0.84	13.71	
Set the online learning goals for each session	0.79	12.47	
Having higher expectations from my online learning	0.81	13.01	
Learner control			0.77
Having ability to measure my progress in online training	0.88	14.24	
Not be distracted by other online activities such as WhatsApp, Instagram and Facebook during online learning	0.54	7.53	
Repeat the online training content according to my specific requirements	0.81	12.63	
Motivation for learning			0.93
Being open to new ideas while learning online	0.88	15.00	
Being motivated to learn online	0.91	15.64	
Consider the previous mistakes to improve my learning	0.91	15.80	
like to share my ideas with others during online learning	0.84	13.77	
Online communication self-efficacy			0.87
Being confident in using online learning tools to communicate with others (friends, professors...)	0.80	12.78	
Being confident in expressing my thoughts and theories about a topic through online text messages (comments)	0.96	17.08	
Being confident in posting my questions in an online discussion	0.90	15.25	

Table 3. Goodness of fit indices of the Persian version of online learning readiness scale in confirmatory factor analysis

Goodness of fit indices	Present study	Acceptance range
Normed Chi-square	3.2	1-5
Standardized Root Mean Square Residual (SRMSR)	0.06	<0.05
Comparative Fit Index (CFI)	0.97	>0.90
Incremental Fit Index (IFI)	0.97	0-1
Normed Fit Index (NFI)	0.95	>0.90
Non-Normed fit index (NNFI)	0.96	>0.90

Discussion

The aim of this study was to investigate the psychometric properties of the Persian version of the OLR. Cronbach's alpha was calculated to be 0.95 for the entire scale and ranged from 0.74 to 0.93 for the subscales, indicating the Persian version's strong reliability. The original version of the scale also reported combined reliabilities between 0.72 and 0.87, which were considered acceptable, as a combined reliability

exceeding 0.70 is generally acceptable. This study demonstrated that all subscales exhibited good combined reliability (8). In another study by Engin, Cronbach's alpha was reported to be within the range of 0.65 and 0.86 (9). A separate study conducted in Turkey further confirmed the reliability and validity of this tool (10). In the present study, during the construct validity assessment of the Persian version of the scale, most of the goodness-of-fit indices met acceptable standards, indicating the approval of the proposed model with its 5 subscales. In the original scale and other similar studies, the validity of the proposed model was consistently confirmed. Consequently, the Persian version of the scale exhibits good validity and reliability and can be effectively utilized to assess the readiness of learners for online education. The experience gained during the COVID-19 pandemic underscores the utility of virtual training as an alternative or complementary approach to conventional training methods. Therefore, evaluating learners' readiness to embrace virtual education is essential to fully

harness the benefits of this mode of learning when necessary.

The current study revealed that the participants' average scores in all subscales exceeded the mid-point

score of 2.5 (on a scale of 5). Similarly, Farazkish et al. reported that students' perceptual readiness for e-learning in 15 selected universities in our country was 4.9 out of 10, indicating a moderate level of students' perceptual readiness (11).

Table 4. Comparison of the mean score of readiness for online learning readiness scale subscales in health workers based on the participants' characteristics

		Computer/internet self-efficacy	Self-directed learning	Learner control	Motivation for learning	Online communication self-efficacy
Gender	Male	3.97(0.69)	3.94(0.69)	3.62(0.47)	4.03(0.580)	3.86(0.75)
	Female	3.76(0.98)	3.47(0.86)	3.29(0.95)	3.58(1.02)	3.71(1.01)
P Value		0.340	0.010	0.120	0.040	0.490
Experience of online education	No	3.56(0.96)	3.40(0.97)	3.34(1.14)	3.53(1.25)	3.43(1.14)
	Yes	3.83(0.95)	3.56(0.83)	3.33(0.89)	3.66(0.93)	3.79(0.94)
P Value		0.150	0.390	0.940	0.590	0.100
Level of Education	Diploma	3.84(0.69)	3.75(0.68)	3.63(0.78)	3.99(0.66)	3.86(0.78)
	Associate degree	3.66(1.03)	3.56(0.98)	3.44(0.96)	3.62(1.09)	3.84(0.98)
	Bachelor's degree and higher	3.81(1.05)	3.39(0.85)	3.09(0.95)	3.44(1.04)	3.59(1.08)
P Value		0.580	0.06	0.003	0.008	0.210
Workplace	Urban	3.77(1.02)	3.45(0.89)	3.23(0.96)	3.49(1.06)	3.68(1.04)
	Rural	3.82(0.74)	3.74(0.69)	3.59(0.80)	4.02(0.62)	3.86(0.80)
P Value		0.770	0.040	0.020	0.001	0.250

Values are as mean (standard deviation)

Moreover, based on the findings of Mohammad Ismail and Karimi's study (12), the average e-learning readiness of information science students was 4.09, surpassing the mid-point. To elevate the readiness for electronic learning beyond the average level, planning computer skills and English language training for students can be considered.

Furthermore, our study identified that the average scores for self-directed learning, learner control, and motivation to learn were significantly higher among health care workers in rural areas compared to their urban counterparts. Longer work experiences among health workers in rural areas may partially account for this finding. Conversely, the lower motivation for online learning among urban health care workers may be attributed to their higher levels of education compared to their rural counterparts. However, the higher average age of health care workers in rural areas did not justify this difference, as an inverse correlation (though non-significant in some subscales) was observed between participants' average age and all subscales. It is worth mentioning that factors such as inadequate training, limited access, and the ability to use online learning technology can significantly impact the readiness for online learning in both groups. In this regard,

Shahnavazi et al. found that due to the lack of appropriate technological infrastructure for e-learning, only 32.3% of students exhibited a high level of readiness for this type of learning (13).

Another notable result of the present study was that the mean scores for all subscales of readiness for online learning were higher among male health care workers compared to their female counterparts. However, this difference was statistically significant only in the self-directed learning and learning motivation subscales. In line with these findings, a study by Kabir et al. highlighted that lower acceptance and lack of self-confidence were 2 significant reasons for female nursing students' reluctance to prefer online learning. These researchers also pointed out that factors such as age, educational qualification (similar to the current study), place of residence, parents' education level, having a single room, vision problems, and access to technology were related to the acceptability of e-learning (14). In general, several studies have explored the impact of gender on online learning outcomes and have reported varying results (15). Some studies have found no significant differences in terms of readiness for online learning, motivation, performance, or satisfaction between men and women (16). Interestingly, during the

COVID-19 pandemic, some studies reported that women outperformed men in online learning, especially in academic performance (17). Moreover, in a study conducted by Nicol et al., gender did not play a significant role in students' online learning readiness (18). While some studies have indicated the influence of gender on online learning readiness, the findings in this area are not consistent, suggesting the need for further research to gain a better understanding of the relationship between gender and online readiness.

Results of the present study, although not statistically significant, suggested that a history of online education might be directly related to the level of readiness for online learning. In a study investigating this relationship, the results indicated that previous experience with online education was a significant predictive factor for students' readiness for online learning (19).

One of the strengths of the current study lies in the examination and confirmation of the psychometric properties of the OLRs, which can be applied in future studies involving different populations. Another noteworthy aspect is that most previous studies in this field focused on students who were actively engaged in some form of learning. In contrast, the present study targeted health care workers who were on the front lines, actively involved in patient care, and where the outcome of their continuous training directly impacts the health care system and public health. Given the geographical dispersion of health centers in our country, conducting face-to-face continuous training programs for this group would entail significant costs and time. However, with the provision of suitable virtual training infrastructure in the country, especially following the experience of the COVID-19 pandemic, virtual training can be effectively utilized for the ongoing training of community health care providers at the primary level. Enhancing their readiness for online learning can help overcome many limitations related to time and location. Nevertheless, it is essential to note that the current study is cross-sectional in nature, and caution should be exercised when generalizing its results. Additionally, due to the cross-sectional design, causal relationships cannot be investigated.

Conclusion

The present study demonstrated that the Persian version of the OLRs possesses appropriate psychometric properties and can serve as a valid and reliable tool to assess the online learning readiness status of medical

learners. Furthermore, given the applicability of online training for health service providers, it is imperative to consider factors related to online learning readiness, including demographic factors and job characteristics, before planning such training programs.

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The Current Outlook in the Internationalization of Medical Education in Pakistan

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Abstract

Background: Internationalization in medical education (ME) creates new potentials, and links among countries.

Objectives: The present study aimed to investigate the current outlook on the internationalization of ME in Pakistan.

Methods: This case study had an outlook on the internationalization of ME in three top universities in Pakistan. The most significant components, characteristics, and variables related to ME were identified and categorized. The reports regarding the educational, research and health system performance of this country were collected by reviewing the grey literature, and visiting the official websites of these universities.

Results: To improve their competitive capacities Pakistan's top universities have considered some research parameters, unique strategies (motivational mechanisms for target groups of students, and professors, educational mechanisms and empowering students and professors, mechanisms for communicating with other pioneering universities, and mechanisms for communicating with the industry and exchanging intellectual capital), and short-, medium- and long-term plans for attracting capital, exchanging scientific products, and sharing experience.

Conclusion: Pakistan's success in internationalization depends on factors, such as concentrating on science and technology, the enhanced role of the local government and the privatization of HE institutes, including modern ideas and making changes in the country's cultural structure, using English as the primary language in universities, designing web portals based on international criteria, receiving tuition fees from international students, designing programs for international students, hiring foreign faculty members, and sending professors abroad to take part in specialized courses, and making efforts to monitor international initiatives and ensuring quality.

Keywords: Internationalization, Medical Education, Pakistan, Higher Education

Background

Improving medical education is one of the concerns of each country's education system (1). Today, by developing social media, the promotion of ME has experienced international progress. This is due to the fact that because science's geographical borders have

dissolved, new problems in the area of education have surfaced. Globalization and internationalization of ME are hence necessary and unavoidable changes (2). Internationalization is "the process of integrating an international, intercultural, or global dimension into the purpose, functions or delivery of postsecondary

education” (3). Internationalization is a continuous effort to internationalize education, including ME (4), and many countries have initiated the process of becoming integrated into global education (1, 5, 6).

Medical universities can increase the capacity for the admission of foreign students to not only attract young personnel but also introduce universities to the world (7). Besides, disregarding the causes of other countries’ success, and not benefiting from their experiences will delay the internationalization process. Universities need to heed the concept of internationalization, and the factors affecting education, such as attracting elite students, making changes in the content, and providing educational programs in accordance with health needs, and the provision of medical services (8). Providing raw materials and turning them into valuable products is better to be based on the culture to benefit society (9). Providing a road map of ME can considerably help pave the way for the internationalization of the medical universities (10).

Objectives

Since ME is an exception, all countries should take measures to achieve a decent position in this regard. Pakistan is the only neighbor of Iran relating to the internationalization mission of Kerman as the main pole of the country’s eighth region. Its geographical nearness, cultural similarities, and recent collaborations make this country as a good target for international relations. Therefore, this study aimed to investigate the current outlook of ME in three top universities in Pakistan, assess the present policies for ME in these universities and offer suggestions regarding future strategies for ME at the international level in Iran. One of the most well-known worldwide university ranking systems is the Times Higher Education Ranking System, which takes into account 13 functional characteristics to provide thorough and fair comparisons. These indicators are divided into five groups: education, research, citations, industrial income, and international reputation (11). The selection of Pakistan was due to the issue that it is one of the countries associated with the internationalization mission to Kerman as the main pole of the country’s eighth region.

Methods

This is a case study that describes the current outlook in the internationalization of ME in Pakistan’s three top universities (Quaid-i-Azam University, the University of Lahore, and the University of Karachi) based on Times Higher Education World University Ranking at

the time of the study. Based on the literature review, the most significant components, characteristics, and variables related to ME were identified and categorized. The reports regarding the educational, research and health system performance of this country were collected by reviewing the grey literature. Afterward, the required information was collected from the official websites of the Pakistan universities. In the cases when required information was not available on the websites, it was acquired via e-mail contact with the universities. This study was approved by the ethics committee of KMU (IR.KMU.REC.1400.257).

Results

Karachi, Lahore, and Quaid-i-Azam Universities were the top three international medical universities in Pakistan according to THE rankings. English was the primary language used on the websites of the universities and colleges, and it was also the language of instruction for foreign majors at all of these institutions. Examining the letters between and among universities revealed that they communicated in English as well. Furthermore, an English certificate or records of studying in an English-speaking university/school was necessary for (native/ non-native) students to enter any level.

The educational curriculums of all the majors in these universities were based on the international standards, and students willing to study medicine had to take part in a 4-5-year course as their undergraduate degree. Then, they had to go through an apprenticeship in a hospital. Having finished this stage, they could select specialized majors after passing entrance exams and being interviewed.

University of Lahore had the highest number of professors, as well as the highest variety in the majors offered in the field of pharmacy among three universities. However, it offered one undergraduate major in the field of medicine. Moreover, universities of Lahore and Karachi offered master’s degree majors. Quaid-i-Azam University offers a wider range of majors in the field of medicine, especially in MD degrees. On a global scale, there was a severe lack of both the quantity and diversity of nursing and allied health degree programs. Not to mention that certain majors, including anesthesia and surgical technician, were reserved for students from the host country. These universities’ regulations, the same as the others in Pakistan, were set by the health department of the corresponding province. However, all universities had to make their policies based on Pakistan Medical and Dental Council

(PMDC). In this country, university admission is based on PMDC instructions. Applicants' scientific performance presented as grades in their higher secondary school certificate (HSSC) and an entrance exam, such as MDCAT were qualifications necessary for being accepted in most of universities. Therefore, all main rules and regulations were based on PMDC and Pharmacy Council of Pakistan (PCP).

The universities of Lahore and Karachi were similar in terms of various dentistry majors. In these universities, the students willing to study dentistry had to pass a 4-5-year course as their undergraduate degree, after which they served a one-year apprenticeship in a hospital. Then, they could study specialized majors after taking entrance exams and being interviewed.

Universities of Lahore and Karachi ranked 801 in THE rankings, while Quaid-i-Azam University ranked 500. If we compare these three universities' educational capacity based on this ranking, we can see that Quaid-i-Azam University had a greater professor-to-student ratio but fewer students overall than the other two. At the University of Lahore, however, there were more international students than at the other two. The research parameters of Pakistan's top universities included research grants offered by these universities, published articles, research fields, and active research collaborators, the percentage of research budget in the total university budget, patents, registering inventions and trademarks, and licenses (Table 1).

Each of Pakistan's universities had unique strategies to internationalize their education, which are presented in table 2. The strategies encompassed motivational mechanisms for specific groups of students and professors, financial mechanisms, legal mechanisms, educational mechanisms, and measures to empower students and professors. Additionally, there were mechanisms to foster communication with other leading universities, engage with the industry, attract financial capital, and exchange intellectual capital (Table 2).

To improve their competitive capacities, Pakistan's universities have considered some short-, medium- and long-term plans for attracting capital, exchanging scientific products, and sharing experiences, which are discussed in table 3.

Discussion

This study aimed to investigate factors affecting the internationalization of ME in Pakistan's universities. The results showed that Pakistan considered some factors in the internationalization of education, which

has replaced its previously predominant education system with these factors. In order to address the demand for education and give access to high-quality education, Pakistan's policy emphasized public-private partnerships. As a result, targeted privatization measures were implemented, particularly in rural regions. In this process, private and semi-private companies were encouraged to participate in this significant matter.

A series of events has led to Pakistan's success in the internationalization of education. Decentralization, gender equality, efficiency, quality human capital, and privatization have entered the educational policies (12). In addition, an increase in the number of applicants for education worldwide is evident, and almost every nation in the world considers the development of education as a national agenda (13).

As in the present study, all the universities studied had modern or semi-modern research centers, and all of them collaborated with leading research centers in the world. Therefore, up-to-date technologies provide the opportunity for international professors, and students to further their scientific objectives based on global developments in their field of interest. The privatization process has created a competitive environment. Equality of rights has become important, and no local school displays its heritage or follows local cultures, racism, or sexism that are contrary to global cultures. The focus is more on commonalities than differences because this system focuses on national development and individual growth.

British colonialism, however, led to the slow entry of the English language into the vocabulary of people and prepared the ground for the acceptance of this language in universities. English is still mainly used in education and as an official language in the country (14). People with a neutral attitude may use English as a means of communication without considering cultural and social aspects (15). On the other hand, English acts as a gatekeeper for most jobs in Pakistan (16). For instance, graduates without English proficiency hesitate to apply for the jobs they are interested in (17). The majority of the primary websites linked to these three institutions are created in English and, by today's standards, promote visitors from other countries, making these universities more appealing to prospective students.

Table 1. Research parameters of Pakistan’s universities

Research Parameters	University of Karachi	University of Lahore	Quaid-i-Azam University
Research grants	Establishing a financial support office to support qualified, and necessitous students and provide them with their educational expenses Paying the costs of research trips and participation in seminars and conferences to the students and professors	The financial aid office disburses educational grants to those who need financial assistance for their higher education. Providing scholarships to necessitous qualified students	Allocating 25% of research grants to female students Providing educational grants to foreign students, especially those from Germany, France, and the US Establishing a financial aid office to manage those eligible to receive grants Providing research grants to all the M.Phil./Ph.D. students Providing research grants, such as scholarships for minorities, political agent scholarships (FATA), financial support of the Zakat committee of the district, Baluchistan/ FATA scholarship, Karwan-e-Ilm Foundation of Lahore, Aga Khan Development Network, Sindh endowment fund, Balochistan Education Endowment Fund
Articles	Indexing of 10971 articles of this university in different databases 506 articles published in 2006 Approximately 1200 articles published by the Department of Pharmacy Publishing 1447 articles between 2007 and 2010 Having more than 60 registered inventions in the field of scientific research	Publishing 5920 articles in reputable journals	Publishing 2918 articles by this university’s researchers
The proportion of the research budget to the total budget	Allocating 18% of university’s budget to research	Allocating 20% of university’s budget to research	Allocating 24% of university’s budget to research
Active research fields	Having 27 research centers at University of Karachi (ten centers focused on medicine, pharmacy, and allied health professions) Having several Pharmaceutical laboratories Having 94 universal research fields	Having four research centers Vast research in 183 fields	Information was not available
Patents, registering inventions, trademarks, and licenses	ORIC: Office of Research Innovation and Commercialization is responsible for all the affairs related to registering inventions, intellectual property, trademarks, and work licenses Enhancing technology transfer by investigating the opportunities for issuing licenses and joint investments Contributing to the university and country’s economic growth by helping natives implement their ideas	Information was not available	Some of the inventions were commercialized and trademarked: Commercial use of enzymes domestically produced by the microbiology department in poultry feed, producing environmentally-friendly leather, using microbial lipase in detergents and chemical fertilizers
Active research collaborations and partnerships	The highest level of collaboration with the US, England, Turkey, and Germany	Research collaborations with several international institutes such as Duke University, University of Houston Texas, University of Pittsburgh, Center for Disease Control and Prevention in the US, University of Liverpool, University of Glasgow, University of Nottingham, University of Reims Champagne-Ardenne, and The University of Münster	Conducting research activities in international educational and research institutes such as the UNESCO, IRSIP, Agencia Espanole de Cooperacion Internacional (Spain), and so on, in collaboration with this university

Table 2. Strategies used by Pakistan’s universities for internationalization

Strategies	University of Karachi	University of Lahore	Quaid-i-Azam University
Motivational mechanisms for target groups of students	<p>Online admission system (Only accessible to international students)</p> <p>Variety of courses offered in different majors with a cost-effective expenditure structure</p> <p>Supporting students’ intellectual property of their invention</p> <p>Providing grants for research travels and participation in seminars and conferences</p>	<p>Providing financial support to students</p> <p>Offering Language courses to the accepted students</p> <p>Providing welfare facilities and accommodation to students</p> <p>Offering a wide range of medical majors in accordance with international standards</p> <p>Providing grants to students for research travels</p> <p>Active research centers and libraries</p> <p>Providing job services to students after graduation so they can enter the labor market</p> <p>Helping international students get their visa</p>	<p>Providing welfare facilities such as dormitories and transportation</p> <p>Providing financial support to students, especially German, French, and American students</p> <p>Providing educational courses according to international standards</p> <p>Assisting with the commercialization of students' ideas and giving work opportunities after graduation</p> <p>Sending students to take part in international conferences, and courses abroad</p> <p>Providing English courses to the accepted students</p> <p>Helping international students get their visa</p>
Motivational mechanisms for target groups of professors	<p>Offering grants for research travels and participation in international seminars and conferences</p> <p>Supporting professors’ intellectual property of their invention</p> <p>-Providing job offers to professors</p>	<p>Offering research grants to professors</p> <p>Providing welfare facilities to professors</p> <p>Sending professors to other countries to take part in research courses</p>	<p>Providing welfare facilities such as accommodation to professors and their families</p> <p>Helping professors and their families get their visa</p> <p>Sending professors on research trips to participate in international conferences</p> <p>Offering research grants and providing proper research facilities, such as laboratories and specialized equipment</p> <p>Providing job security by signing mutual contracts</p> <p>Providing educational courses in English</p>
Financial mechanisms and financial support	<p>Providing financial resources with the cooperation of private sector and receiving a budget from the government</p> <p>Charging students with tuition fee</p> <p>Generating revenue through the organization of seminars, scientific excursions, educational classes, and courses for reeducation</p>	<p>Collaboration with the private and non-government sectors and applicants</p> <p>Covering the main part of the university’s expenses by charging students with tuition fee</p> <p>Providing approximately 20% of the university’s revenue through employers (private sector), and research institutes signing contracts with HE institutes to implement research projects</p> <p>Some private agencies’ role in covering hospital expenses</p>	<p>Receiving funds from the government</p> <p>The budget allocated to Pakistan’s HE by the government</p> <p>Collaboration with the private sector (signing contracts with educational institutions, knowledge enterprises, industrial workshops, and research institutes)</p> <p>Receiving funds to validate and provide facilities such as laboratory equipment and participating in research projects</p> <p>Receiving financial help from some countries, such as Germany to establish centers such as the Taxila Institute of Asian Civilizations (TIAC)</p> <p>Charging students with tuition fee</p>
Legal mechanisms	<p>Approving educational courses by the university and holding examinations under its provision</p> <p>Responsible for holding exams and entrance exams for itself and 145 colleges and institutes affiliated with the university</p> <p>Enforcement of university laws and regulations by the region’s health department</p> <p>Setting policies and laws and regulations based on the criteria proposed by the PMDC and PCP</p> <p>Admission to medical university based on PMDC (HSSC and MDCAT) instructions</p>	<p>Enforcement of university laws and regulations by the region’s health department</p> <p>Setting policies and laws and regulations according to the criteria proposed by the PMDC and PCP</p> <p>Admission in medical university based on PMDC (HSSC and MDCAT) instructions</p>	<p>The same as Lahore</p>

Table 2. Strategies used by Pakistan’s universities for internationalization (continue)

Strategies	University of Karachi	University of Lahore	Quaid-i-Azam University
Educational mechanisms and empowering students	<p>Modernizing the facilities in physics, chemistry, food science, and industry, statistics, biotechnology, computer sciences, and mass communication fields to improve the quality and productivity</p> <p>A counseling office guiding foreign students regarding the admission process and facilitating registration in different departments</p>	<p>Establishing the research, innovation, and commercialization office</p> <p>Department of Job services, and corporation links in the university</p> <p>Providing workshops, discussions, seminars, one-on-one coaching sessions, etc.</p>	<p>The research, innovation, and commercialization office</p> <p>Holding online and in-person educational workshops for students</p> <p>Holding international courses with the cooperation of other domestic and international universities</p> <p>Inviting native and international professors</p>
Educational mechanisms and empowering professors	<p>Establishing the research, innovation, and commercialization office, and helping professors commercialize their ideas</p> <p>Offering reeducation courses to professors</p> <p>Sending professors to educational and research courses</p> <p>Holding international conferences and creating international links to collaborate with foreign professors</p>	<p>Offering reeducation courses to professors</p> <p>Sending professors to educational and research courses</p> <p>Holding international conferences and creating international links to collaborate with foreign professors</p>	<p>Offering reeducation courses to professors</p> <p>Establishing occupational adjustment for professors</p> <p>Providing financial support for research</p>
Mechanisms for communicating with other pioneering universities	<p>Establishing centers called Quality Enhancement Cell (QEC) that are responsible for corresponding with outside bodies of university, revising quality standards and the quality of teaching and learning in each field, establishing academic relationships with other institutes regarding effective management of standards and quality of programs, monitoring students, professors, and staff’s performance, quality management process, teaching, and informing process, purchasing products, designing and development process, service provision process, product management process, the process of managing contact with clients, internal quality management, monitoring and measurement process, and management assessment process</p> <p>Offering an annual program called Continuing Dental Education Programs at Altamash College to facilitate the entrance of new sciences to Pakistan by inviting foreign professors</p> <p>Partner universities: The Australian National University, University of Canberra, Inserm, The University of Paris, The Max Planck Society, Germany; Pasteur Institute of Iran, University College Dublin, Ireland; Sains University of Malaysia, Ohio University, Bua University, Auckland University</p> <p>International professors working with this university: Prof. Dr. Hans Yornvall, Prof. Dr. Stephen Pennington, Dr. Aftab Ahmed, Prof. Dr. Roman Zubarev</p>	<p>Signing memorandums of understanding with universities of Afghanistan, Azerbaijan, Congo, Iraq, Pakistan, Sudan, Turkey, Uganda, and Northern Cyprus</p> <p>Research collaboration with international institutes such as Duke University, University of Houston Texas, University of Pittsburgh, Center for Disease Control and Prevention in the US, University of Liverpool, University of Glasgow, University of Nottingham, University of Reims Champagne-Ardenne, and The University of Münster</p> <p>Inviting international professors to present some courses</p>	<p>Signing memorandums of understanding with universities all over the world, such as Atatürk University (Erzurum, Turkey), Ball State University, Muncie Indiana, USA ‘ University of Jordan ‘Canadian company Health Consortium of Canada (HCC) ‘Turkish Cooperation and Coordination Agency (TiKA) ‘Taras Shevchenko National University of Kyiv, Ukraine‘ Beijing Institute of Genomics of the Chinese Academy of Sciences, China</p> <p>Doing research with international educational and research institutes such as UNESCO, IRSIP, and Agencia Espanolede Cooperacion International (Spain)</p>

Table 2. Strategies used by Pakistan’s universities for internationalization (continue)

Strategies	University of Karachi	University of Lahore	Quaid-i-Azam University
Mechanisms for communicating with the industry, attracting financial capital and exchanging intellectual capital	<p>One of the pioneering universities in patent</p> <p>Encouraging investors from outside the university and helping new ideas emerge by creating links between the labor market and the university’s scientific and research products</p> <p>Establishing a unit called Industry Liaison Cell as a bridge between the academic setting and the labor market</p>	<p>Exchanging intellectual capital and attracting investments by holding educational courses for graduates and, helping them establish science enterprises and sending staff to these institutes</p> <p>Achieving the remaining portion of the university's costs via partnerships with the commercial and nonprofit sectors.</p> <p>Covering the main part of expenses by charging students with tuition fee</p> <p>Signing contracts with employers (the private sector) and research institutes to implement research projects in collaboration with HE institutes and paying tuition fees to the university (approximately 20% of the university’s revenue)</p> <p>Another approach of this university to increase its capital was to satisfy the educational needs of industrial and commercial centers</p>	<p>Commercializing the university’s research and sending the products to the market</p>

Table 3. Plans used by Pakistan's universities for internationalization

Plans	University of Karachi	University of Lahore	Quaid-i-Azam University
Short-, medium- and long-term plans for developing manpower in different medical majors in the country and abroad	<p>Designing 4-year courses to attract foreign students</p> <p>Including some new subjects in the modified curricula of 4-year program to create more opportunities in the labor market</p> <p>Inviting foreign professors to teach at the university</p> <p>Regularly appointing parties to attract native and foreign professors</p> <p>Offering evening courses to increase the capacity of accepting students</p> <p>Improving entrepreneurship and commercialization activities</p> <p>Offering internship courses</p> <p>Developing and enhancing research programs</p> <p>Creating direct links between research activities, and educational, industrial, and social sectors</p> <p>Promoting multidisciplinary and interdisciplinary research</p> <p>Increasing and diversifying foreign research budget</p> <p>Translating the studies in favor of people</p> <p>Internship opportunities</p> <p>Case studies competitions</p> <p>Updating the demand and supply of resources</p>	<p>Conducting continuous studies to improve the quantity and quality of education and research in the university</p> <p>Self-evaluation by the university</p> <p>Analyzing student processes in top international universities and following suite</p> <p>Planning and conducting feasibility studies on open and distance education</p> <p>Planning some courses to be online</p> <p>Evaluating the potential for admission in various majors using faculty data</p>	<p>Holding seminars, educational workshops, conferences, and continuous education programs for academics and professional pharmacists</p> <p>Designing collaboration programs and creating links with national and international educational and research institutes</p> <p>Establishing a unique and advanced medical research center able to register new and generic inventions in pharmacy</p> <p>Promoting the pharmacy department to a national center and establishing a national pharmaceutical sciences university to meet the needs of national and multinational pharmaceutical industries and other educational institutes, research, and healthcare</p> <p>Analyzing student processes in top international universities and following suite</p>
Plans for attracting capital	<p>Office of Research Innovation and Commercialization (ORIC), and creating links with agencies for budget provision</p>	<p>Attracting capital by signing international memorandums of understanding and creating links with international agencies</p>	<p>Mentioned in the previous part</p>
Plans for exchanging scientific products and sharing experience	<p>Establishing centralized laboratories to increase the research capacity</p> <p>The most important journal of this university at the international level: Karachi University Journal of Science</p>	<p>Pakistan Journal of Molecular Medicine (PJMM)</p> <p>Journal of Media, Business & Social Sciences (JMBSS)</p> <p>Asian Journal of Allied Health Sciences (AJAHS)</p>	<p>Collaboration with government and private sector universities in innovative research</p> <p>Collaboration with domestic and international organizations active in similar research</p> <p>Establishing a national and international assembly by holding seminars, and conferences for discussion of scientific and technological developments</p> <p>Pakistan Journal of Social Sciences</p>

Reviewing the majors offered at these three universities and comparing their titles and curricula with those of prestigious universities worldwide and international standards indicates that Pakistan has tried to arrange its academic majors in a way that native and foreign students are more willing to be admitted in these universities knowing that the certificates, and majors offered are internationally valid and their chances of admission are also higher.

In this new university system, it is possible to commodify universities by allowing them to charge foreign students tuition fees, which leads to a reduction of the economic burden on the government and private centers and attraction of foreign currency.

As seen, these three universities provided facilities to attract international students, such as 1) Free access to research databases 2) Student insurance 3) Free access to laboratory equipment 4) Grants for presenting research papers in international conferences 5) Free access to university workshops 6) Free access to library books 7) Helping graduate students find jobs.

As mentioned earlier, each university has a limited number of foreign faculty members. Moreover, every university has plans to send its professors, and students to foreign countries to participate in specialized courses.

Pakistan has approved a program to attract and employed foreign professors to its universities. Furthermore, this country invites foreign professors to implement short-term educational programs in Pakistan at public or private universities to hold workshops/seminars for native graduate students. These partnerships provide ongoing exchanges between Pakistani and international institutions, which has an impact on faculty recruitment and research partnerships. Besides, HEC has developed a program to provide financial aid to Pakistani researchers to travel to foreign countries. In this program, financial assistance is provided to university faculty members, staff, and Ph.D. students of public and private universities to participate in international conferences, postdoctoral research, or any type of research (18). HE institutions in Pakistan are trying to improve research culture and are organizing international conferences, encouraging researchers to conduct research, and publishing journals at the international level.

Conclusion

The reasons for Pakistan's success in the internationalization process can be attributed to factors, such as the focus on science and technology, the

advanced role of the local government and the privatization of HE centers, the introduction of modern ideas and changes in the country's cultural structure, using English as the main language in universities, designing web portals based on global standards, creating diversity in majors and making them conform to international standards, receiving tuition from international students, designing programs for international students, employing foreign faculty and sending professors abroad to take specialized courses, and trying to monitor international initiatives and ensure quality.

As a comparative view, for the internationalization of medical education in Iran, it is recommended to rely on the priorities of own educational system and use other universities and medical education abilities as a model to improve all aspects of internationalization.

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Investigating the Knowledge of General Dental Students and Residents Regarding Practical Self-Assessment Skills

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Abstract

Background: Self-assessment (SA) means assessing or judging efficiency, and identifying strengths and weaknesses to improve learning outcomes.

Objectives: The present study aims to investigate the knowledge, and attitude of the students of Kerman Dental Faculty regarding practical self-assessment skills.

Methods: This cross-sectional descriptive-analytic study included 220 residents, and general students of Kerman Faculty of Dentistry. Data was collected using a questionnaire consisting of two parts. In the first part, the demographic information was recorded. The second part questioned students' knowledge and attitude toward practical self-assessment skills. The intra-class coefficient and content validity index of the questionnaire were 0.72 and 0.83, respectively. Data were analyzed using a T-test, analysis of variance, and multivariate regression in SPSS 21 software. P-value<0.05 was considered as the statistical significance level.

Results: The results indicated that the average score of questionnaire was 44.45 ± 6.58 for women and 42.60 ± 5 for men, which was significantly higher in the female students (P-value=0.02). Moreover, the average score of residents was 46.4 ± 6.21 , considerably higher than general students (42.99 ± 5.80) (P value = 0.01). Finally, the average score of students at public colleges was equal to 44.48 ± 6.10 , higher than that to those studying at private colleges (41.56 ± 5.35) (P-value = 0.01), which shows better self-assessment skills.

Conclusion: The study highlights the critical role of self-assessment skills to improve the dental students learning ability, performance, and independency. Moreover, it is recommended that regular self-assessment skills be considered significantly in dentistry curricula.

Keywords: Self-Assessment Skills, Practical Self-Assessment, Dental Students

Background

Factors affecting learning are classified into two areas: personal and environmental. Individual factors include learners' behaviors, flexibility, self-assessment, willingness to learn, and motivation. On the other hand, the environmental factors include the environment, and physical resources, concentration on the result of education, achievement of teaching and assessment

goals, promoting learning via student-student interaction, valuing students' opinions, encouraging students to provide feedback on the teaching method, professors' support, and student participation (1). Nowadays, most universities are looking at educational ways to strengthen clinical decision-making abilities and ongoing self-centered learning; nonetheless, teaching in Iran often includes transferring knowledge from the

professor's head to the student (2). Assessment is one of the essential parts of education process at any level, classified into three groups: Formative, Diagnostic, and Summative (3). In formative assessment, assessments run during learning while professors' teaching students' learning is still ongoing. In the diagnostic assessment, it is tried those appropriate problem-removing methods be taught to professors in addition to identifying students' learning problems. In the summative assessment, students' learning during a specified course is determined, aiming to score students, and judge the professor's teaching and curriculum (3).

At the beginning or conclusion of the course, the professor or another person might conduct the skill evaluation. The assessment method should be reliable, flexible, comprehensive, easy, relevant, and quick. One of the assessment methods is student self-assessment (4). Self-assessment (SA) means evaluating or judging efficiency, and recognizing one's strengths and weaknesses to improve learning outcomes (5). Since the primary goal of education is to create long-term and non-dependent learning, SA helps students move towards the reflective practice (6). SA skill is essential to ensure effective learning and should be taught to students which may not be innate, but it is an acquired skill. SA and other clinical skills must develop simultaneously. Studies showed that student self-assessment of practical skills is more valuable than common university assessments, including written and practical exams; therefore, in addition to the professor's judgment, student self-assessment is performed in many universities (2).

Many studies showed that learners can accurately judge their performance and support the reliability, and benefits of SA for formative objectives (7). Traditional self-assessment methods are not effective in changing professor-based to student-based approaches. A student-centered approach primarily emphasizes the actions and efforts made by students in the learning process, rather than those of teachers (8). The primary purpose of higher education is to improve independence, and life-long learning, both of which help the students to become "reflection practice" students who can criticize their professional performance (9). Reviewing students' views on gaining clinical skills can be named one of the activities that can facilitate learning in the clinical environment (10). As training methods and tools are constantly developing, it is imperative that assessment methods adapt accordingly. In general, students do not accurately self-

assess because they tend to assess the actual success potentials and levels instead (11). Researchers showed that students with high success usually underestimate themselves, while less successful students overestimate themselves (12-15).

Many international studies addressed student self-assessment in pharmacy education (16-20), medical education (21-25), and dental education (26-29). Dentistry is a self-analytical profession, and dentists should be able to assess each procedure properly.

Research conducted on students specializing in pediatric dentistry has shown that the majority of students need practical instruction, while only one-third feel adequately equipped to engage in patient care (30-32). Moreover, factors like previous experiences and lacking suitable facilities influence this attitude. In general, results show a need for more efforts to improve clinical teaching in pediatric dentistry. Furthermore, researches show that using appropriate assessment tools and necessary instructions for faculty members can improve the learning process of dental students (33-35).

Self-assessment is a critical skill that dentists should possess as oral health care providers (28). Self-assessment is defined by İncesu et al. (21), and Guo et al. (36) as a process in which students assess the quality of their thinking and behavior while learning, and identifying strategies to improve their understanding skills. This concept is approved in the studies of Zarei Hajiabadi et al., Sáinz et al. and Li et al. (37-39) Habib et al. (27) showed that self-assessment is a valuable learning technique in dentistry because it improves performance at every step. Accurate self-assessment enables self-reflection on one's strengths, and weaknesses which is one of the essential features of self-directed learning. However, the role of student self-assessments is still very controversial despite some efforts to clarify this aspect of learning compared to professors' assessments (12, 14, 19, 30).

Objectives

Considering the importance of self-assessment skills, and their effect on student's learning, the present study aimed to evaluate the perceived SA skills of general students and residents of Kerman Faculty of Dentistry.

Methods

The present cross-sectional descriptive-analytical study was conducted on 220 dental residents, and third to sixth-year general students of the dentistry faculty of Kerman University of Medical Sciences selected by

census sampling method in 2020-2021. Initially, a comprehensive roster was compiled for both third to sixth-year general dental students and residents, which were obtained independently from the vice chancellor for education office of the dentistry faculty. The total number of students was 220 (137 general and 83 residents), all them were included in the study except the ones with no tendency for participation.

The data collection tool included a questionnaire consisting of two parts. The first part contains questions on gender, age, level of education, academic year, and type of admission (public or private colleges). The second part consists of 14 questions on perceived self-assessment skills. These questions were taken from the study by Abdullah et al. (11).

To assess the validity, the questionnaire was given to ten pediatricians and oral and dental disease specialists, and a content validity index (CVI) of 0.83 was obtained, which was acceptable, and their comments were applied to the questionnaire. To assess the reliability, the questionnaire was distributed and then collected among 20 students. Two weeks later, the same students completed the questionnaire again, and the intra-class coefficient (ICC) was calculated at 0.72, as well as Cronbach's alpha 0.68. The questionnaire was scored based on a five-point Likert scale as follows: totally agree=4, I agree =3, I have no opinion = 2, I disagree = 1, Totally disagree = 0. Furthermore, the score of the answers in the questions with the opposite direction (questions 8, 9, and 14) is as follows: Totally agree = 0, I agree = 1, I have no opinion = 2, I disagree = 3, and I Totally disagree = 4. The possible score range is 0 to 56, which indicates the lowest and the highest level of student-perceived self-evaluation skills. Regarding the response rate of 100%, to categorize the questionnaire scores, students' self-assessment skills were divided into three levels: low (0-18), moderate (19-37), and high (38-56).

Data analysis was done using a t-test, analysis of variance, and multivariate linear regression analysis in SPSS Ver. 21. P-value<0.05 was considered as the statistical significance level. Kerman University has approved this study of Medical Sciences with the code of ethics IR.KMU.REC.1398.712.

Results

A total of 220 students and residents of Kerman Faculty of Dentistry participated in the present study. The mean \pm SD of participants' age was 24.38 ± 2.68 . The demographic characteristics of the study population in

demonstrated in table 1. The lowest and the highest scores obtained were 30 and 56, respectively (mean \pm SD = 43.69 ± 6.03), which is at an acceptable level. The mean score obtained by general dental students was 42.99 ± 5.80 , and the mean score residents was 46.4 ± 6.21 , respectively (Table 2).

Table 1. Frequency distribution of the participants according to demographic characteristics

Demographic characteristics	Frequency (%)	
Gender	Female	129(58.6)
	Male	91(41.4)
Study level	General dentistry	175(79.5)
	Dental residency	45(20.5)
Academic year	Third	37(21.1)
	Fourth	36(20.7)
	Fifth	51(29.1)
	Sixth	51(29.1)
Type of admission	Public	160(72.7)
	Private	60(27.3)

Students' SA scores were classified into three low (0-18), medium (19-37), and high (38-56) groups, which are shown in figure 1 in the form of percentages (be noted that there is no score in the low group). Based on figure 1, most students (84.1%) obtained high scores in SA skills.

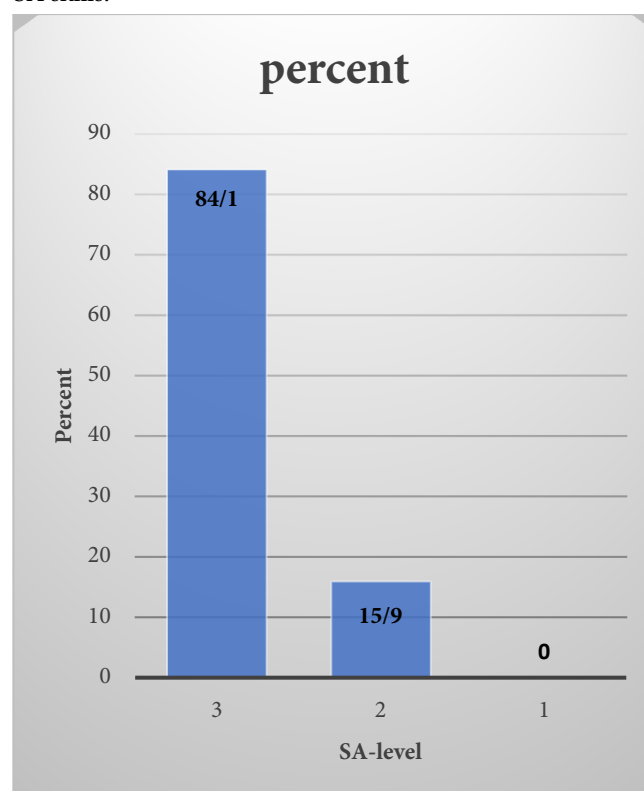


Figure 1: Student-perceived self-assessment

Table 2. Comparison of questionnaire scores by demographic information

Demographic characteristics	Number	Mean (SD)	P-value
Gender	Female	91	42.60 (5.00)
	Male	129	44.45 (6.58)
Study level	General dentistry	175	42.99 (5.80)
	Dental residency	45	46.40 (6.21)
Type of admission	Third	160	44.48 (6.10)
	Private	60	41.56 (5.35)

Table 2 shows the results of T-test regarding average questionnaire scores based on gender, educational level, and type of admission. Based on the findings, female students demonstrated superior performance in terms of their understanding of self-assessment abilities compared to their male counterparts ($P=0.02$). Thus, the residents showed higher knowledge compared to general students in this regard, which is statistically significant ($P=0.01$). Hence, table 2 shows that students which were admitted in the form of public, have higher self-assessment skills compared to the ones with private type of admission in the university ($P=0.01$).

Regression analysis showed that female students, residents, and public college students scored significantly higher, which confirms the results of table 2 which was done by T-test. In other words, the regression analysis shows that the probability of the presence of higher self-assessment skills in students increases with age, higher level of education, and also difficulty in university acceptance (Table 3). Also, table 3 suggests that increasing the level of academic year in general dental students did not affect the perceived self-assessment skills in any way.

Table 3. The relationship between SA knowledge and study variables according to multiple regression analysis

Model	B	SE	T	P-value
(Constant)	49.024	4.145	11.828	0.000
Sex	1.726	0.811	2.128	0.034
Age*	-0.436	0.199	-2.190	0.030
Grade	4.306	1.412	3.049	0.003
Academic year	-0.176	0.505	-0.348	0.728
Type of admission	-1.784	0.966	-1.846	0.066

SE: Standard error

Dependent Variable: SA.

Sex: male, female. Grade: general dental student, resident. Academic year: third year, fourth year, fifth year, sixth year. Type of admission: public, private. *reference level is 20 and over.

Discussion

The findings of the current research indicate that the mean self-assessment skill score of the students was deemed satisfactory, aligning with the findings of Abdullah et al. and Munoz et al., who indicated favorable views among students (11, 40). Siow et al.

studied the perceived SA of nutrition students using a questionnaire, and suggested that most of the participants agreed that SA makes them independent; however, only half of the participants stated that SA helps them learn independently. This discrepancy may be because there is a greater need for dental professor training than nutrition science (6).

Siow et al. reported that 52% of students believed that SA benefits them, and only 13% disagreed with this idea (6). However, 85.9% of students in the present study agreed, and 7.7% disagreed.

Gholami Salehabadi et al. stated that most students were satisfied with self-assessment and believed that concentration, and thinking were effective in learning. According to the source, self-assessment has been shown to have a favorable impact on students' performance in reading comprehension examinations, long-term education, and understanding of relevant methods (41). The students stated that self-assessment improves their performance, which is consistent with Salehabadi's study.

In a systematic review by Mays et al., limited information was found about any systematic student self-assessment training. They found that the effect of self-assessment on students' performance needed to be clarified in most of the studies. Mays showed a need to pay more attention to regular self-assessment training in the oral health curriculum (42).

Wiley et al. found that more than 69% of the participants believed that self-assessment and peer assessment improve their learning ability, consistent with the present study (43). McDonald et al., concluded that SA training could positively affect students' performance, and students of the current study had a favorable view in this regard (44).

The current study showed that female students achieved superior scores compared to male students, in line with the findings of Wiener et al. (26), which indicated that the self-assessment scores of female students were higher than those of male students. The result of present study was consistent with the results of studies that analyzed the self-assessment skills of

American dental and medical students by gender (25, 26). This result was consistent with another study that analyzed European non-medical students (45). The findings of this study and their consistency with other studies indicate that despite different educational systems, and curricula in different parts of the world, gender differences cause differences between male and female students due to perceived self-assessment skills. Colbert-Getz et al. (22) also stated that these scores are affected by anxiety and self-confidence. Female students may outperform male students because they study harder and are more prepared (46). Therefore, it can be concluded that female students had more self-confidence than male students. As a result, female students showed a far higher level of willingness to rate the items in the self-assessment questionnaire compared to male students. On the contrary, Vivekananda-Schmidt et al. (47), Deveze et al. (23), and Rees et al. (48) stated that female students tend to underestimate their self-assessment scores compared to male students (23, 48). There is a need for further studies on the relationship between self-assessment scores and gender.

Dental residents obtained higher scores than general students, and it is completely predictable, maybe because they have received more training courses, and the residency courses are more student-based compared to general dentistry curricula, which leads to more learning independence. White et al. stated that nursing students who gradually gain self-confidence in the clinical environment would gain a greater understanding of the clinical environment, better self-understanding, and be able to function independently, and focus on patients (49). Such findings could be applied to the dental educational environment, and as our study suggests, improving SA knowledge increases learning independence and performance. Bagherzadeh et al. suggested that public college students obtained higher scores than private college students, and the self-confidence of public college students is probably higher than private college students in some cases, which affects their self-assessment score, which is completely in line with our findings (50).

Yazdani et al. studied the opinions of final-year students of dental schools in Tehran, Qazvin, Semnan, and Qom regarding the acquired clinical skills using a self-assessment questionnaire. The authors stated that dental schools must make positive and constructive learning changes based on students' points of view to encourage and create more motivation and thus ensure

sustainable and continuous learning which is completely consistent with our findings (51). Biglerkhani et al. measured the knowledge and mastery of oral surgery skills among final-year students through a self-assessment method. The researchers documented the most elevated self-evaluation rating for the abilities that students had encountered in the corresponding departments (52). Also, the findings of Willey et al. (43), Iguchi et al. (53) and Muñoz et al. (40) seem familiar to our results, because we found that residents SA skills are at a higher level compared to general dental students, and that is attributed to their advanced learning courses along with more independence in training.

It is necessary to explain that the present study had some limitations, which affected the results to some extent. The most important of these limitations are as follows:

- The lack of a clear and precise definition of self-assessment skills caused students to answer questions based on their experiences, and personal understanding of its meaning.
- It was challenging to have access to the students considering the current pandemic and subsequent closure of the Kerman Faculty of Dentistry. Consequently, the researchers sent the questionnaires online, reducing the opportunity to explain the subject and clarify the study objective somewhat, although the self-assessment was defined at baseline.

Conclusion

The results of present study show that dental students of Kerman University of Medical Sciences have a high level of knowledge and understanding of practical self-assessment skills. The results also indicated that female students exhibited a greater level of knowledge and comprehension in SA skills compared to male students. Additionally, students enrolled in public universities shown a better level of SA skills compared to those in private institutions. Furthermore, residents exhibited a higher level of SA skills compared to general students. Considering the importance of self-assessment in the learning process, it is suggested to design SA teaching programs for professors as well as students, especially dental students.

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Pharmacology Teaching Methods and Affective Factors in Their Success in Educating Undergraduate Medical Students: A Scoping Review

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Abstract

Background: Pharmacology is one of the crucial subjects of medical courses because drugs are the basis of disease treatment. A basic drug description is needed to optimize benefits and reduce side effects. Therefore, proper education for medical students is necessary.

Objectives: This scoping review aims to investigate the methods, ideas, and recommendations for educating undergraduate medical students in pharmacology.

Methods: To achieve the purpose of the study, related studies in English and Persian were reviewed within 2010 to 2022. A comprehensive systematic literature search was carried out in PubMed, Web of Science, SCOPUS, Google Scholar, and ProQuest databases to conduct this review. Two independent reviewers evaluated the retrieved publications and extracted the data using the Joanna Briggs Institute's standardized tools. Primary study findings were read and reread to identify teaching methods used in the studies for undergraduate medical students. The extracted findings were categorized based on their similarity.

Results: A total of 56 studies were included in this scoping review. More than 70% of articles have been performed in India. The results were presented according to the teaching methods used in educating: team-based learning, computer-assisted learning, the autobiography of medicines, role-play, integrated education, case-based learning, problem-based learning, student-led objective tutorials, e-learning module, museum, pre-lecture, concept mapping, crossword puzzles, game, flipped classroom, and mixed methods.

Conclusion: This review provided a new vision about the methods of pharmacology education that have been used worldwide. The information obtained can be used to revise traditional teaching methods of pharmacology in medical schools.

Keywords: Pharmacology, Teaching Methods, Medical Students

Background

The field of pharmacology is considered a separate pre-clinical field in the standard curriculum of medical sciences. In most cases, it is offered together with other pre-clinical lessons (e.g., anatomy, physiology, and biochemistry). The scientific basis for the rational and safe prescription of drugs is discussed in pharmacology; therefore, incorrect and insufficient training and a lack of skill in prescribing and providing advice on how to use medicines correctly can threaten the health of patients or lead to death. Due to the importance of this field, pharmacology should be considered a required

course in medicine, nursing, pharmacy, dentistry, and many other medical curricula (1).

Traditional pharmacology education is lecture-based and deals with learning factual knowledge about drugs, which causes students not to be adequately trained in therapeutic applications. In this type of education, professors are the main body of education teaching abstract knowledge to students, which reduces their ability to practice and solve problems. In addition, decreasing the power of active learning and independent thinking is another disadvantage of traditional education (2). To revise the educational goals and align with the

required competencies, a curriculum should be developed as necessary in education.

Based on the importance of pharmacology education, the analysis of teaching and evaluation methods should be prioritized, and modifying these methods based on students' feedback can be effective (3). Active learning is one of the most influential and essential parts of education that enables students to use the acquired knowledge by involving them in the learning process. Lack of active learning can neglect learned knowledge, and using this information without understanding it makes future discussion difficult. Students usually recognize pharmacology as one of the most tedious and time-consuming courses. However, active learning increases motivation, promotes critical thinking, and improves students' performance compared to individuals exposed to traditional and common education fields (4).

Nowadays, the use of new teaching techniques is considered a necessity due to the increase in the number of drugs and the acquisition of more and more accurate information about the mechanisms of drug action, especially at the intracellular and genomic levels (generally, pharmacological characteristics), require revisions in traditional teaching methods. The development of society and the progression of the standard of living mean that conventional medical services do not respond to the needs of patients, and individuals demand higher standards of health services, which themselves require initiative in education (5). Therefore, the challenge of effective pharmacology education has attracted much attention, and its goal is to empower students to make rational treatment decisions in clinical scenarios.

Considering that teaching the essential and elusive topics of pharmacology effectively is necessary, it was decided to examine pharmacology education methods for medical students systematically.

Objectives

This scoping review aimed to detect the most promising educational methods in pharmacology and identify their weaknesses and strengths. By using the results of this review, it will be possible to identify the most effective and applicable teaching method and improve the quality of the learning process.

Methods

In this scoping review, following the Joanna Briggs Institute (JBI) instruction (6), the methods of pharmacology education for undergraduate medical

students and the factors affecting the success of their usage in educating medical students were reviewed and categorized.

Research Questions

1. What study designs have been done in teaching pharmacology to undergraduate medical students?
2. What are the main concepts of teaching pharmacology to undergraduate medical students?
3. What methodology has been mainly used in related studies?
4. Which country accounts for the largest share of studies?
5. Which of the methods of pharmacology education are more prominent worldwide?
6. Since what year has the role of using new methodologies in education become more eminent?
7. How do various educational methods contribute to the success and effectiveness of teaching pharmacology to undergraduate medical students?

Inclusion Criteria

To screen the various studies obtained from the search phase, we set specific criteria to select the ones related to the research topic and to exclude the studies that did not include the specified conditions. The inclusion criteria were as follows:

Participants (population): The studies included undergraduate medical students.

Concept (intervention): Studies included one of the methods of teaching pharmacology.

Context: All medical schools in the world.

Outcome: Students' final grade, satisfaction with the teaching method, and student participation rate.

Type of studies: Original quantitative studies with different study designs and qualitative studies with different methodologies were included. Studies that were not written in English or Persian, published as an abstract only, and listed in databases other than those mentioned were excluded.

Search Strategy

This scoping review searched both published and unpublished (gray literature) studies. An initial search was conducted on MEDLINE and CINAHL databases to develop a search strategy. The main keywords for search, based on the research question, were pharmacology, teaching, teaching methods, medical students, educational methods, and training. Search strategies are attached in [Appendix 1](#).

This review was limited to studies published in English and Persian. Only publications published after 2010 were included to evaluate the latest teaching methods. The following databases were searched in this

review: PubMed, SCOPUS, Web of Science, Cochrane, and ProQuest. The Google Scholar database was also searched for Persian studies.

Papers published in 2021 and 2022 in medical education journals, such as Medical Education, BMC Medical Education, Academic Medicine, Teaching and Learning in Medicine, Clinical Teacher, and Medical Teacher, were searched manually. Websites of associations, including "The International Association for Medical Education (AMEE)", "ACGME (Accreditation Council for Graduate Medical Education)", "World Federation for Medical Education (WFME)" or "The Association for the Study of Medical Education (ASME)", were also searched. The articles' reference lists were also explored.

A comprehensive search was conducted in corresponding databases, such as ProQuest, GreyNet, and Google Scholar, to assess related gray literature. In case of any missing data or confusion, the authors of primary studies were reached. The references and citations of included studies were examined to prevent any missing articles. To complete the data and prevent any misunderstanding, further connection was made with the principal authors of related fields.

Study Selection

After searching each database, the items found were entered into EndNote x8 software (Clarivate Analytics, PA USA), and duplicate items were removed. Later, the relevant file regarding the articles' titles and abstracts was reviewed and screened separately by two independent reviewers. The full text of the studies which

met the inclusion criteria were then screened. In the event of disagreement between the two reviewers, the relevant cases referred to a third reviewer.

Data Extraction

The data extracted from the full text of the articles were further reviewed and analyzed to provide collected data on research questions. The data were extracted from the full text of the articles by two independent reviewers using the specified checklist (Appendix 2). No errors were found in the extracted data, including information related to the citation, country, type of study, teaching method, number of participants in each training course, the role of professors, teaching skills, and resources.

Data Synthesis

After extracting all the papers' findings, they were grouped based on their concepts and similarities to develop categories. One of the reviewers extracted findings and developed categories, which other reviewers then checked for accuracy.

Results

Study Inclusion

Initial search results across all databases resulted in 1,286 articles. After removing duplicate items (n = 412) and screening the titles and abstracts, 479 articles remained. The full texts of these studies were investigated for further details. Another 423 articles were removed, and 56 articles were finally included in this review (Table 1). The results of the article selection are depicted in Figure 1.

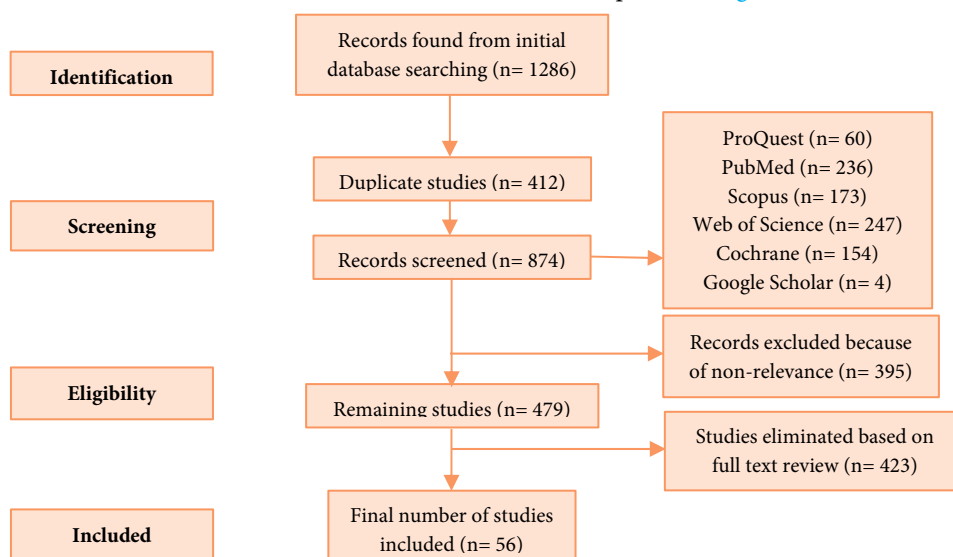


Figure 1. PRISMA study selection and inclusion process

Table 1. Studies Included in the Scoping Review

No.	First Author	Year of Publication	Country	Study Design	Educational Context
1.	NK Zgheib (7)	2010	Lebanon	Case-based	Team-based learning
2.	ParamaSengupta (8)	2017	India	NM	Computer-assisted learning (CAL)
3.	Sunil Nettath (9)	2019	India	Quasi-experimental	
4.	R. Amirtha (10)	2017	India	NM	
5.	Anuradha Joshi (11)	2015	India	NM	Autobiography of medicines
6.	BhargavPurohit (12)	2020	India	NM	Role-play
7.	Supriyo Choudhury (13)	2015	India	Cross-sectional	
8.	S.H. Lavanya (14)	2016	India	Questionnaire-based	
9.	S. Daniel Gotardelo (15)	2014	Brazil	Questionnaire-based	Integrated teaching module
10.	Preeti P Yadav (16)	2016	India	NM	
11.	Shahram Ejtemaei (17)	2011	Iran	NM	
12.	Gurleen Kaur (18)	2020	India	NM	Case-based learning
13.	Ameya A. Hasamnis (19)	2019	Malaysia	NM	
14.	Kanchan Gupta (20)	2014	India	NM	
15.	UK Chiranjeevi (21)	2022	India	Questionnaire-based	
16.	Sandhya K. Kamat (22)	2012	India	NM	
17.	Amit Kumar (23)	2016	India	NM	
18.	Sachidananda Adiga (24)	2010	India	NM	Problem-based learning (PBL)
19.	KD Karpa (25)	2013	USA	NM	
20.	Parama Sengupta (26)	2021	India	Quasi-experimental	
21.	Anupama Sukhlecha (27)	2016	India	Prospective	Student-led objective tutorials (SLOTs)
22.	Kriti Arora (28)	2016	India	NM	
23.	MNS Adiga (29)	2020	India	NM	
24.	P. B. Patel (30)	2018	India	Prospective, single-group, pre-post intervention	E-learning models (ELMs)
25.	Raakhi K Tripathi (31)	2017	India	Prospective, single-group	
26.	Nitin Gaikwad (32)	2013	India	Quasi-experimental	
27.	Urwashi I. Parmar (33)	2018	India	Prospective interventional	Pharmacology museum
28.	Marya Ahsan (34)	2016	India	Randomized controlled trial	Pre-lecture assignment (PLA)
29.	Sarmila Nath (35)	2021	India	Cross-sectional interventional study	Concept mapping module
30.	Vimala Ananth (36)	2021	India	Quasi-experimental	
31.	Nitin Gaikwad (37)	2012	India	Open-label, randomized, controlled, parallel-group intervention	Crossword puzzles
32.	FA dos Reis Lívero (38)	2020	Brazil	NM	Game-based learning (GBL)
33.	AM Gudadappanavar (39)	2021	India	NM	
34.	Anuradha Joshi (40)	2015	India	Randomized control	
35.	John Wilhelm (41)	2021	USA	NM	
36.	Sarah A. Aynsley (42)	2018	United Kingdom	NM	
37.	H Jaiprakash (43)	2022	Malaysia	NM	Flipped classroom
38.	Sushil Sharma (44)	2017	India	Interventional study	Scenarios approach
39.	Margaret Shanthi FX (45)	2016	India	Crossover, Randomized	Tutorial/Self-study
40.	Jennelle Richardson (46)	2021	USA	NM	Over recorded lectures
41.	IPK Demak (47)	2021	Indonesia	Quasi-experimental	Peer tutoring methods
42.	Helen Qin (48)	2022	Australia	NM	Peer teaching initiative
43.	Dinesh K Badyal (49)	2018	India	Mixed method	Immediate feedback
44.	Amy C. Halliday (50)	2010	United Kingdom	NM	Primary research resources
45.	Dinesh K. Badyal (56)	2010	India	NM	Mix method
46.	Raakhi K. Tripathi (57)	2015	India	NM	
47.	R Ramachandrudu (58)	2016	India	NM	
48.	Vikas Seth (59)	2010	India	NM	
49.	HS Amane (60)	2013	India	NM	

50	Preethi J Shenoy (61)	2021	India	NM	Mix method
51..	Rajesh Kumar (62)	2021	India	Questionnaire-based	
52.	Patil Banderao (63)	2018	India	Cross-sectional	
53.	Parimala K (64)	2013	India	Questionnaire-based	
54.	Vasudha Devi (65)	2016	India	Review	
55.	Rashmi Raghava Rao (66)	2020	India	Cross-sectional	
56.	Uma A. Bhosale (3)	2013	India	Cross-sectional	

NM, not mentioned

While screening articles, the reviewers did not identify any scoping review articles assessing pharmacology teaching methods and their features.

Review Findings

The studies differed in the type of training method, the number of participants, and the outcome measures. All participants were undergraduate medical students, and the length of the educational intervention was different. A summary of the included studies based on indicators, such as first author, study design, and number of participants, is shown in Table 1. Most of the studies (43 studies) were from India. The remaining 13 studies were conducted in the USA (3), United Kingdom (2), Brazil (2), Lebanon (1), Malaysia (2), Iran (1), Indonesia (1), and Australia (1). From 2015 onwards, studies show an increasing tendency.

The results are reported based on different teaching methods used in educating undergraduate medical students (Figure 2).

Team-Based Learning: Team-based learning (TBL) is an innovative teaching approach that enhances active learning, with studies indicating improved student performance. Zgheib et al. (7) described TBL in three phases. Phase 1 involves PowerPoint lectures introducing educational materials and explaining the TBL method. In phase 2, students individually answer "true/false" and "multiple-choice" questions, and in phase 3, they form groups for collaborative question-solving and class discussions. Positive student feedback and improved test results were observed, compared to traditional courses.

Computer-Assisted Learning: Computer-assisted learning (CAL) is a method used in medical education. It can replace traditional lectures and complement conventional teaching methods. Sengupta et al.(8) used "EP Dog version 1.1.0" and Nettath et al. (9) and Amirtha et al. (10) used "Ex-Pharm T 1.0 Software", for teaching to evaluate the change in knowledge gained by students compared to conventional lecture-based methods. Multiple-choice questions analyzed students' knowledge. Studies have shown that integrating CAL with previous teaching methods can improve students' performance and increase their scores.

Autobiography of Medicines: Medicine autobiography is an educational method where medications provide information about their characteristics, pharmacokinetics, pharmacodynamics, dosage, pharmaceutical form, uses, mechanisms, and side effects. Joshi et al. (11) and Purohit et al. (12) used this method, which shows that combining this method with traditional education has many advantages. Still, it cannot replace the lecture-based method. The biography can be used at the end of classes to review the materials taught, which will increase the enthusiasm and curiosity of the students.

Role-Play: Role-playing effectively facilitates active learning, enhancing students' communication skills in pharmacology education. Choudhury et al. (13) demonstrated its application in teaching the mechanism of antimicrobial drugs inhibiting bacterial protein synthesis. Students assumed roles, such as the peptidyl site, host site, t-RNA, and tetracycline, guided by the teacher. Lavanya et al.(14) limited role-playing to three students per session, playing doctor, patient, and observer after a lecture. A post-session Likert scale assessment indicated positive effects on learning and communication skills. In another study, Gotardelo et al. (15) explored role-playing's impact on medicine-related information implementation through a show format, revealing dynamism, efficiency, and creativity in education according to Likert scale and DREEM results.

Integrated Education: Integration is an effective teaching method in medical education. The lack of integrity in conventional teaching methods has caused students to have a poor understanding. Using an integrated method in education can improve students' performance. Yadav et al. (16) and Ejtemaei-Mehr et al. (17) designed and implemented integrated training in the following topics: "basal ganglia,""epilepsy, and tuberculosis and their treatment management." In integrated education, topics related to anatomy, physiology, pharmacology, neurology, microbiology, and pathology were formed. The students noticed and welcomed these sessions and improved their reasoning and self-directed learning.

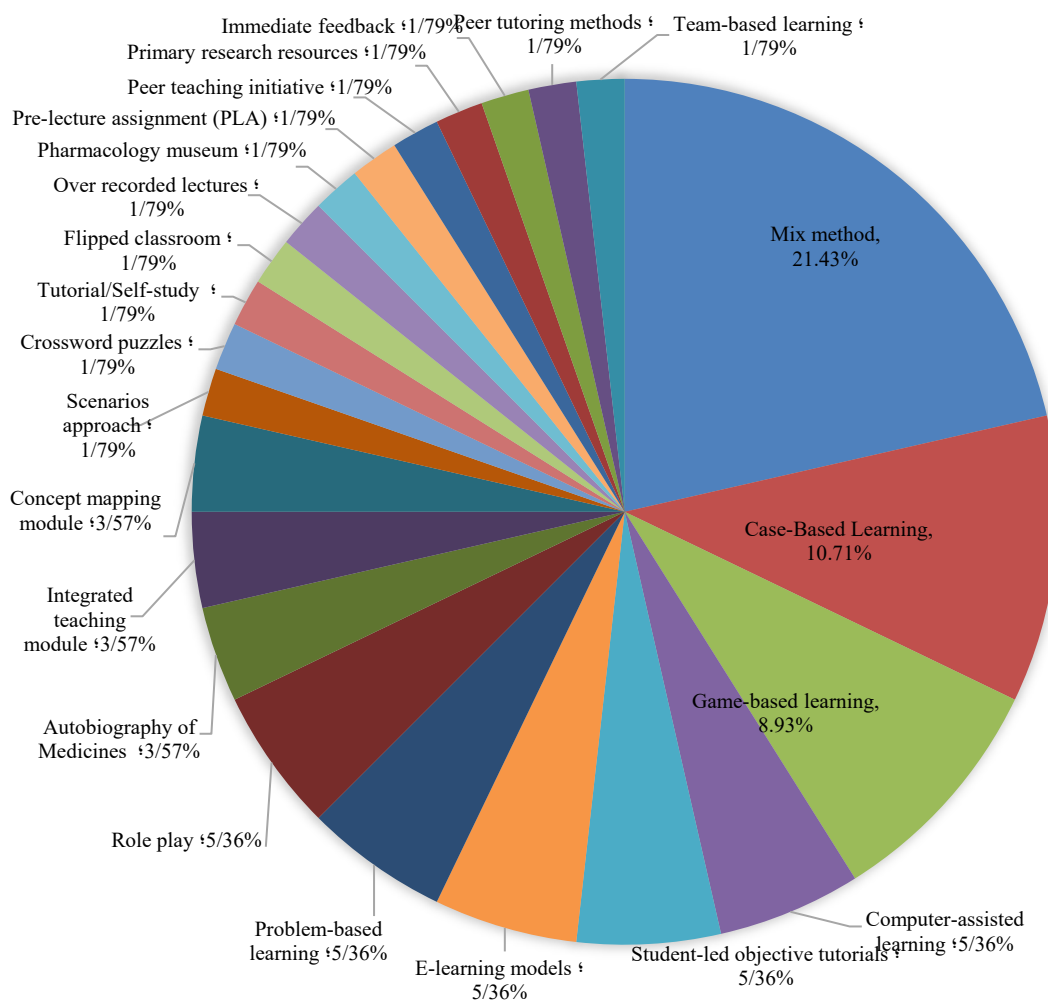


Figure 2. Teaching methods in included studies based on frequency percentage

Case-Based Learning: Case-based learning (CBL) is a globally applied, creative teaching method utilizing clinical cases as training stimuli. This approach enhances students’ understanding of real-world situations, facilitating better retention of educational material. Numerous studies comparing lecture-based and CBL methods consistently demonstrate the latter’s effectiveness. Pre- and post-tests consistently indicate improved performance and increased scores among students taught using CBL, compared to traditional methods (18-23).

Problem-Based Learning: Problem-based learning (PBL) is a student-centered approach where students collaborate to solve real-world problems. Studies by Adiga et al. (24) and Karpa et al. (25) emphasize PBL’s integral role in education. The method involves group discussions to address unfamiliar issues, fostering interactive learning. Sengupta et al. (26) compared PBL in the classroom and on WhatsApp. In both settings,

students respond to problems, with WhatsApp offering a hybrid approach. Although not a classroom replacement, WhatsApp’s use aligns with the global rise in social media usage, providing an additional avenue for PBL implementation.

Student-Led Objective Tutorials: Student-led objective tutorials (SLOTs) are one of the methods to increase students’ motivation and strengthen active learning through group work. Sukhlecha et al. (27), Arora et al. (28), and Adiga et al. (29) investigated the effectiveness of using SLOTs compared to using conventional methods (CT). The students were divided into two groups: the first group received traditional training, and the second group used the SLOT method. Both groups initially received traditional lectures. In SLOTs, subgroups created and presented multiple-choice questions, fostering active engagement. The results indicated that SLOTs improved learning, increased interest, and strengthened active learning,

compared to CT. Student-led objective tutorials can be integrated into curricula alongside traditional methods.

Electronic Learning Module: Electronic learning (E-learning) is one method that strengthens self-directed learning and provides easy access to educational content. This method can be used to complete lecture classes. Patel et al. (30) used the Microsoft 2007 and iSpring Suite (8.3) for this task. The perception of students and professors was collected using the Survey Monkey tool. Tripathi et al. (31) and Gaikwad et al. (32) also investigated the effectiveness of this method through a pre-and post-test. The results show that this method can be combined with the traditional method and is simple and affordable.

Pharmacology Museum: Parmar et al. (33) used the pharmacology museum as a teaching and learning method. The museum includes medicinal samples in different medicinal forms. The teaching-learning method (TL) consists of 2 phases. In step 1, students are instructed to visit the museum and observe various forms of medicine. A pre-and post-test was taken for evaluation. In step 2, the students will be allowed to volunteer at the museum and solve their problems with pharmaceutical forms. The results showed that the museum could strengthen students' knowledge about medicinal forms; however, making the environment attractive for students can be challenging.

Pre-lecture Assignment: Ahsan et al. (34) used pre-lecture assignment (PLA) as a teaching technique. In this method, students were randomly divided into two groups. For the first group, before the lecture session, a clinical case of peptic ulcer was explained in detail, and they were asked to give an assignment about the treatment approach of the case. Pre-lecture assignment was done 5 days before the presentation of the speech. The first group only participated in the lecture session. The results showed that this method can make learning more active and reduce teacher-centeredness in education.

Concept Mapping: A concept map is a graphic, educational method in which concepts and the relationship between them are displayed in a visual form. Understanding the whole concept using a single figure makes this method more effective for medical students. Nath et al. (35) and Ananthy et al. (36) showed that this technique can complement the educational program.

Crossword Puzzle: Crossword puzzles are an attractive way to review and identify keywords and

critical information. It can be used as a self-testing tool. Gaikwad et al. (37) used a crossword puzzle on the topics of antihypertensive and antiepileptic drugs. Pre- and post-tests were taken from the students. The results showed that this method can be used as a self-education tool to improve students' knowledge.

Game-Based Learning: Game-based learning (GBL) is increasingly employed in education for its ability to enhance motivation and engagement. In pharmacology education, various games have been explored. Lívero et al. (38) examined 11 games (Appendix 3); however, Gudadappanavar et al. (39) implemented the "hot seat race" method, demonstrating its effectiveness through pre-test and post-test results. Joshi et al. (40) used cricket as an innovative teaching tool, finding no significant test score difference but increased student engagement. Wilhelm et al. (41) investigated virtual games during the coronavirus disease 2019 (COVID-19) pandemic, with Trivia being preferred and positively impacting pharmacology learning. Aynsley et al. (42) utilized the "Braincept" card-based game, noting improved self-confidence and practical pharmacological knowledge in students after gameplay. The aforementioned findings collectively emphasize the potential of GBL in diverse educational contexts.

Flipped Classroom: The use of this method became common during COVID-19. Heethal Jaiprakash (43) used this method to measure the knowledge of students trained using online tools. Before the training session, materials for reading, including PowerPoint and AMBOSS links, were sent to the students. The students were taken pre-and post-tests during the session, and their feedback was evaluated using a 4-point Likert scale. The results showed that the students better understood the subject, which improved their knowledge.

Other Methods: In addition to the methods mentioned earlier, noteworthy approaches deserve attention. Sharma et al. (44) explored the use of end-of-lecture scenarios, enhancing students' application of medicinal knowledge. The results indicated increased student engagement and improved grades. Shanthi FX et al. (45) compared traditional education to self-study, emphasizing the necessity of instructor-led education for better comprehension. Richardson (46) employed pre-class recorded lectures to provide students with prior knowledge, fostering increased interaction during class.

Demaket al. (47) investigated peer tutoring, noting increased motivation but no significant improvement in

scores, highlighting the importance of selecting committed peer tutors. Qin et al. (48) implemented peer-led training using Pecha Kucha principles, yielding positive results for review sessions. Badyal et al. (49) introduced immediate feedback in training, demonstrating deeper student understanding and improved grades. Halliday et al. (50) utilized primary research sources for student-led seminar sessions, leading to enhanced learning and competition for utilizing research articles in education.

Mixed Methods: In addition to the studies that have been reviewed, a series of studies also investigated two or more methods side by side and identified the most appropriate and effective method, which are summarized in [Appendix 4](#).

Discussion

This scoping review was conducted to assess teaching methods of pharmacology for undergraduate medical students. Synthesizing the obtained results indicated that the main teaching methods used in the included studies were TBL, CAL, autobiography of drugs, role-play, integrated education, CBL, PBL, SLOTS, e-learning module, museum, pre-lecture, concept mapping, crossword puzzles, game, flipped classroom, and mixed methods.

The traditional curriculum follows the lecture-test method and is teacher-centered, which today has lost its place as a valuable and targeted educational method and has been replaced by new learning and teaching strategies. Learner-centered education causes lifelong learning with greater understanding, improves critical thinking, and allows students to manage the acquired knowledge in different situations and clinical scenarios. The teacher's presence is still necessary in all the methods reviewed in this paper. New approaches do not eliminate the teacher, although the teacher's role and task might differ. As an educational facilitator, the teacher is next to the students and helps them, who need appropriate expertise and knowledge. The need for innovation in training methods is the use of specialized personnel; therefore, in addition to changes in training methods, training of specialized and literate personnel should also be performed(51).

In most cases, the presentation of pharmacology courses is limited to lecture classes; however, it is worth mentioning that lecture classes can also be helpful if the principles of the lecture method are followed. There are many tricks to increase interaction and attention that

should be taught to teachers, which are often neglected and again remind us of the training of experts.

The number of publications related to pharmacology teaching methods has increased significantly in recent years, showing professors' growing interest in alternative teaching methods. In a review by Gill et al. in 2019 (52), several educational strategies used to teach pharmacology to undergraduate baccalaureate nursing students were summarized and compared based on their impact on maintaining pharmacology information, practical pharmacology, and student satisfaction. In this study, online, simulation, and integrated teaching methods were considered more effective and practical, resulting in student satisfaction. However, in contrast to traditional lectures, PBL and flipped classrooms were identified as the least effective methods for education.

Considering the increasing progress of technology and easier access to technology tools, it seems that online learning methods can be effective and in line with the world's needs, which is confirmed by the study of Gill et al. Pharmacology, as a primary subject of medical courses, can be challenging both for teaching and studying. Therefore, newly investigated online methods can be helpful for students and professors. As demonstrated in the included studies, these methods might need further authorization to fit into the education system.

Trullàs et al. (53) in 2022 conducted a scoping review on the effectiveness and efficiency of the problem-based teaching method. According to this study, the PBL method has achieved high student satisfaction because it increases students' communication, social skills, and problem-solving abilities. However, this method is still not recognized globally and is not implemented because it requires human resources and proper and continuous training, which can become a limiting factor for the correct and appropriate implementation. As mentioned in the study of Gill et al., PBL was not the priority of students' choice for education. In this regard, another study was conducted in Iran in 2022 by Sayyah et al. (54), which systematically investigated the use of PBL for the education of medical and nursing students. The results showed that using this method brings better results than traditional education; nevertheless, professors still require more attention for the correct and effective use of this method for teaching. Based on previous results, a suitable platform for using these methods should be provided in medical science universities. Therefore, it is not only challenging to use a new teaching method but

also its accurate and correct implementation is a significant challenge that affects both students and professors and requires further investigation.

In another study by Chen-Lin Xiao (55), a network meta-analysis (NMA) was conducted to evaluate the use of 24 different strategies for pharmacology education. The scores of the theoretical and experimental tests and the students' satisfaction were examined. The results obtained showed that PBL and CBL increased students' grades. Additionally, using PBL, TBL, flipped classroom (FC), and CBL methods is an effective strategy for pharmacology education.

The results of this study indicated the necessity of using innovative methods and active learning in educational curricula. Maintaining the attractiveness of the classroom environment and motivating students requires a change in the usual and traditional methods, as in a study conducted in 2010 by Badyal et al. (56). Based on the feedback they got from the students in 2006, they used innovative education methods. A written questionnaire that included all the different aspects of teaching methods was used in 2007 to evaluate the effectiveness of these strategies.

The results again indicated that the students preferred new teaching methods to traditional teaching and lectures, and their acceptance rate also increased. It is also important to note that students had more demand for practical and clinical training, which indicates the increasing need for changes in lecture-based methods for training. Among the included studies, GBL, CBL, and the use of combined methods accounted for a larger volume of studies. This finding shows that further investigations should be carried out for other possible effective methods.

According to the result of this review, further investigation should be conducted to examine the probable teaching methods that can be suited to education systems. In addition, further studies can evaluate how these methods are entered into daily teaching processes in medical schools.

In general, the conducted studies show that improving the educational methods of pharmacology can ultimately improve healthcare, which has a significant value for society. However, further research is needed to use new and creative teaching methods to educate students.

Strengths and Limitations: This scoping review provides a thorough and detailed summary of teaching approaches in worldwide pharmacology. The review

was completed painstakingly by searching different databases and using a research selection methodology that can be replicated, including independent reviewers. An impressive advantage of this study is its incorporation of a significant number of research papers (n = 56) from a wide range of nations, resulting in strong and comprehensive findings about different teaching methods on a worldwide level. One of the limitations of this study is the lack of critical appraisal of each article to extract the merits and drawbacks of suggested approaches, and it is suggested that future studies perform such an evaluation. At the time of this study, the ERIC database was also not available and, therefore, was not searched. It is suggested that the ERIC database should also be searched to update the results of this review according to accessibility.

Conclusion

This scoping review surveyed the existing literature on instructional approaches employed in pharmacology education for undergraduate medical students. The review emphasized a growing inclination toward integrating contemporary interactive methods that enhance students' readiness for clinical practice by promoting deeper interactivity, self-directed learning, and problem-solving. However, traditional lectures continue to be widely used. Although no single approach has been definitively proven to be superior, certain strategies, such as collaborative learning, CBL, computer-assisted modules, role-plays, and games, have shown the potential to improve motivation, knowledge retention, and skill development. Integrated teaching and multi-modal approaches have also been found to optimize outcomes. However, the selection of methods should be customized to educational priorities and context. Further rigorous comparison studies are required to enhance the evidence on optimal practices since the field is always evolving in response to changing demands. Ongoing research is crucial to optimize the training of future medical professionals.

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Conflict of interest: There is no conflict of interest.

Ethical approval: This study was authorized by the Tabriz University of Medical Sciences ethics committee board (The approval code number: IR.TBZMED.REC.1400.1131). The study was approved by the competent committee at Tabriz University of Medical Sciences, and all procedures were followed in accordance with the rules, regulations, and ethical guidelines that were in force.

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Appendix 1. Search strategies

Search number	Query	Sort By	Filters
4	((((("Pharmacology"[Mesh]) OR (Pharmacology [Title/Abstract])) OR (Pharmacologist [Title/Abstract])) AND ((((((("Teaching"[Mesh]) OR ("Education"[Mesh])) OR (Teaching [Title/Abstract])) OR (Training [Title/Abstract])) OR (Education [Title/Abstract])) OR (Educational [Title/Abstract])))) AND (("Students, Medical"[Mesh]) OR (Medical Student*[Title/Abstract]))		
3	("Students, Medical"[Mesh]) OR (Medical Student*[Title/Abstract])		
2	((((("Teaching"[Mesh]) OR ("Education"[Mesh])) OR (Teaching [Title/Abstract])) OR (Training [Title/Abstract])) OR (Education [Title/Abstract])) OR (Educational [Title/Abstract])		
1	(("Pharmacology"[Mesh]) OR (Pharmacology [Title/Abstract])) OR (Pharmacologist [Title/Abstract])		

Appendix 2. Data extraction table

Data extraction table									
ID									
Title									
1 st Author									
Year of publication									
Journal name									
Country									
Objective of the paper									
Type of study									
Setting									
Method of teaching									
The number of participants per session									
The role of teacher									
Skills necessary for teaching									
Resources necessary for teaching									
Conclusion									
Recommendation									

Appendix 3. Eleven Types of Games in Francislaine Aparecida dos Reis Lívero's Study

No.	Type of game	Procedure	Helper sites	Advantages	Disadvantages
1.	Game of words	The teacher writes two lesson-related sentences in large font, cuts each word, and shuffles them. Students receive these jumbled word papers in envelopes and reconstruct the sentences.	-	1. Increasing student participation 2. Low cost 3. Easy activity	-
2.	Hunting words	The teacher chooses the keywords. It is used at the beginning or end of the session.	Educolorir.com	1. Increase students' attention 2. Remembering keywords 3. Low cost 4. Easy activity	1. Individual activity 2. Lack of interaction between students 3. Lack of critical thinking
3.	Puzzle	The teacher creates four puzzles in different subjects using PowerPoint. After printing and laminating, the 16 pieces are mixed and distributed to groups for arrangement.	-	1. Increasing student participation 2. Increasing discourse among peers 3. Low cost 4. Easy activity	-

4.	Crossword	The teacher selects keywords and essential content and turns them into a crossword puzzle.	Educolorir.com	<ol style="list-style-type: none"> 1. High variety in producing crosswords with the same concept 2. Low cost 3. Easy activity 	<ol style="list-style-type: none"> 1. Individual activity 2. Lack of interaction between students 3. Lack of critical thinking
5.	Tic-tac-toe	In this game, students are divided into two groups and assigned colors. They answer questions to change the color of a square on a board. Correct answers allow them to alter a square to their group's color, while incorrect answers pass the opportunity to the opposing group. The winning group forms a row, column, or diagonal line in their color.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Low cost 4. Easy activity 	<ol style="list-style-type: none"> 1. The possibility of time-consuming construction of boards and facilities
6.	Target shooting	The teacher assigns difficulty scores (1 to 10) to questions and places them in balloons. Groups take turns throwing darts at balloons on the board and answering questions inside. Unanswered questions result in points for the opposing group. The group with the highest points wins. Empty or bonus point balloons add excitement to the game.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Low cost 4. Easy activity 	-
7.	Bingo	The teacher creates a game with 24 questions and answers using Bingobaker.com. Students in groups of 4 or 6 play by listening to questions called out when a bingo ball is spun. Each group marks their cards with the correct answers. The first group to fill a row or column shouts "Bingo" and can win if their answers are correct.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Group work practice 	-
8.	Racetrack	In PowerPoint, the teacher arranges a table with 12 columns for the race route, including start and end points and race rounds. The number of rows corresponds to the number of groups associated with a different machine. In each competition round, the teacher presents two factual/false statements, and groups move forward one step for each correct answer, aiming to reach the path's end.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Group work practice 	<ol style="list-style-type: none"> 1. It takes time to move the cars of each group
9.	Trail	The teacher sets up a course with empty, question, and challenging houses for a dice-based activity. Students split into two groups, taking turns rolling the dice. Correct answers let them stay, while incorrect ones send them back. The first team to finish the course wins.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Group work practice 	<ol style="list-style-type: none"> 1. Large physical space 2. Construction cost
10.	Memorang	Memorang is an educational game designed for content memorization. Teachers create a link to input subject-related cards, and the program generates intelligence games and multiple-choice questions. Students can choose their activities, allowing them to work at advanced levels based on performance. The software enables teacher supervision of each student's progress.	Memorangapp.com	<ol style="list-style-type: none"> 1. Memorizing keywords 2. Easy access to course content throughout the course 3. Creating interest and participation 	<ol style="list-style-type: none"> 1. Lack of critical reasoning 2. The English language of the program

11.	Rally	The teacher creates a 100-question sample test based on recent topics. The class is split into two groups, each further divided into test and support teams. Test teams answer questions independently, while support teams can use all resources to review. They are situated in separate rooms. Team members can switch roles within an hour, and the team with the most correct answers wins.	-	<ol style="list-style-type: none"> 1. Increasing interaction and participation of students 2. Using emotional intelligence 3. Low cost 4. Easy activity 5. teamwork 	-
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Appendix 4. Studies Included Mixed Methods

First Author	Methods	Procedure	Results
Tripathi et al. (57)	Problems about case scenarios, critical appraisal of prescriptions, and drug identification vs. traditional teaching	1) In the case scenario, the group analyzes a case for drug therapy determination. 2) In prescription evaluation, students correct errors in a prescription related to a specific disease. 3) In drug identification, students present a drug's characteristics through a drug autobiography covering pharmacodynamics and pharmacokinetics.	Improving students' grades according to pre-and post-test results, and students prefer active teaching methods.
Ramachandrudu (58)	Chalk talk teaching vs. PowerPoint teaching	Students were split into two groups, one exposed to a chalkboard lesson and the other to a PowerPoint presentation. Subsequently, a questionnaire was administered for evaluation.	Students preferred using PowerPoint and showed better comprehension and retention.
Vikas Seth et al. (59), Amane (60)	The lectures using chalkboard, the lectures using PowerPoint presentations, and the lectures utilizing transparencies with an overhead projector	Students were divided into three groups, each receiving the lecture differently. A test was conducted to evaluate the students' performance and check the effectiveness of the implemented methods.	Students preferred presenting lectures with PowerPoint and considered using this method to be more effective.
Badyal (56)	Lectures, tutorials, seminars, demonstrations, experimental pharmacology, revision class, clinical pharmacology	A written questionnaire evaluated the different methods implemented and examined various aspects of the teaching method.	The students evaluated the use of revision classes as the best method, which is held at the end of the class, and then practical demonstrations were identified as an effective method. The lectures were evaluated as average or ineffective.
Shenoy et al. (61)	Crossword puzzles vs. student-led objective tutorials (SLOT)	Two groups of students were formed: one employed the crossword method, and the other used the SLOT method, involving a contest with self-designed multiple-choice questions. Results were analyzed via an independent t-test using SPSS version 15.	SLOT improves students' grades more than crosswords because it improves critical thinking and teaches teamwork. Students mentioned crossword puzzles to memorize drug names, but it did not affect students' deep learning.
Kumar et al. (62)	Didactic lectures, PowerPoint presentations, case-based learning (CBL), group discussions	The mentioned methods were used during 18 months of student training, and the quality of each method was evaluated using a survey.	The result showed that CBL was recognized as the most effective method, and after that, group discussions and presentations using PowerPoint were accepted.

Banderao et al. (63)	Lectures, audio-visual, discussion of a subject in tutorial classes, interactive learning such as asking questions during pharmacology classes, discussion of graphs	Based on the survey, the teaching methods were investigated, and the perception and feedback of the students were evaluated.	The results show that using audio-visual facilities, for example, educational video clips, helps increase students' understanding. Participating in group discussions increases students' motivation and interest.
Parimala K et al. (64)	Theory lectures, tutorials, student seminars, group discussions, quiz programs, clinical pharmacology sessions	A questionnaire with several options was designed to evaluate the teaching methods, and the results were analyzed.	Based on the results, students evaluated theoretical lectures and clinical pharmacy sessions as more beneficial than other methods. Secondly, group discussions were identified as one of the most effective methods.
Devi et al. (65)	Lecture classes, SDL sessions, problem-based learning (PBL), and case-based learning (CBL)	Methods were evaluated by a short essay and multiple true-false questions (MTF).	The results show an increase in the ability to think critically and problem-solve, the active participation of students, presentation skills, and an increase in information about drugs.
Bhosale et al. (3)	Audiovisual demonstrations, tutorials, student seminars, museum study, clinical (patient-related) pharmacology, integrated teaching, problem-based learning, microteaching	A 22-item questionnaire was designed to examine students' opinions about the quality of teaching methods.	The majority of students preferred clinical pharmacology. As the second priority, they found the use of audio-visual facilities functional. Microteaching and problem-based learning were also prioritized, and students expressed interest in these methods. Seminars and museum studies were also considered educational aids.
Rao et al. (66)	Classroom lecture/ PowerPoint (PPT)/ blackboard/audio video demonstrations/ task-based learning/problem-based learning/assessment for learning/student seminars/small group discussion/integrated teaching	A questionnaire was distributed among students, and their opinions about teaching methods were collected.	Among the mentioned methods, group discussions got the most points among other methods. Among integrated teaching and problem-based learning, students preferred integrated teaching, and lectures were less helpful.

Evaluation of the Feedback on the Attitude, Ethics, and Communication Module by First-Year Faculty Members in Medical Colleges

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Abstract

Background: The National Medical Commission (NMC) of India has prepared a revised graduate medical training program for Indian medical graduates to develop the requisite knowledge, skills, attitude, values, and responsiveness as physicians of the first contact with the community. The attitude, ethics, and communication (AETCOM) module has been prepared as a guide to facilitate implementing a longitudinal program for institutions and faculty members that will help the students acquire the essential competency domains. The present study was an attempt to know the faculty members' perception regarding the AETCOM module based on analyzing and addressing the suggestive measures.

Objectives: To know the faculty perception regarding AETCOM module & based on the analysis, suggestive measures are recommended

Methods: The present research was a cross-sectional study. The data were collected using semi-structured questionnaires. Those who submitted the responses were included in the study. The feedback form, along with the AETCOM module curriculum, was e-mailed to those who have undergone one or the other faculty development training program from different colleges of the first professional year faculties. A total of 34 faculty members out of 60 participated in the study.

Results: About 65% of the participants were females, 50% were professors, and 44% belonged to private and deemed university colleges, respectively. The majority (60%) of the participants were told to reduce the duration of modules and avoid the repetitions concerning the communication skill modules.

Conclusion: According to the study findings, we conclude that the implementation of the AETCOM module is a good initiative taken by the NMC. The competencies specified within each module underscore the importance of cultivating attitudes, ethics, and communication skills among Indian medical graduates, reflecting the contemporary demands and standards of the healthcare profession.

Keywords: Attitude, Ethics, Communication Module, Feedback, Perception, Faculty Members in Medical Colleges

Background

The National Medical Commission (NMC) of India has formulated an updated graduate medical training program aiming to equip Indian medical graduates with the essential knowledge, skills, attitude, values, and responsiveness required to serve as primary healthcare providers within the community through competency-based medical curriculum (CBME). The AETCOM module has been designed to serve as a roadmap for educational institutions and faculty members, assisting them in establishing a comprehensive program that

empowers students to acquire essential competency domains (1).

Knowledge of proper attitude, ethics, and communication skills with the patients plays a vital role in the success of medical professionals. So, the AETCOM module has been formulated to train the medical students from the first bachelor of medicine and bachelor of surgery (MBBS) year as a part of their foundation course as early as possible. Proper physician-patient communication will increase patient satisfaction and also compliance with the treatment (2).

There has been a sudden shift from the pedagogical to the andragogical pattern of learning and education and the module was the very first time introduced into the curriculum for which formal training was conducted under the NMC supervision; hence, the study was planned to represent an endeavor to gauge the faculty members’ perspectives (one of the stakeholders responsible for program implementation) on the AETCOM module. Subsequently, the analysis of their feedback will inform recommendations for improvement and refinement.

Objectives

To know the faculty perception regarding AETCOM module & based on the analysis, suggestive measures are recommended

Methods

The present research is a cross-sectional study and the feedback form, along with the AETCOM module curriculum, was e-mailed to the first professional year medical faculty members who have undergone faculty development training programs like revised basic courses in medical education from different medical colleges. The faculty members’ list was obtained from the regional center for faculty development training. Sixty faculty member e-mails were available and all were enrolled in the study. Faculty members are among the stakeholders of the AETCOM module training; hence, they were selected for the study.

The study was conducted in 2022 after obtaining ethical permission and faculty members’ consent. The AETCOM module feedback was collected through a self-administered, semi-structured questionnaire to collect the data using Google Forum, and the validity of the questionnaire was pretested. Open-ended questions

were asked to explore issues such as the module perceptions, time allotted, and usefulness, as well as student involvement, assessment methods, reflections on the module, advantages of the module, and any suggestions for the improvement of the training using the module. For structured questions, a 5-point (1-5) Likert scale was applied to assess the objectives, duration, teaching-learning methods, and assessment. The statistical analysis was performed for quantitative data using SPSS software version 20, and content analysis was performed for qualitative data. The studied variables were gender, designation, years of experience, and the type of institute working presently, which underwent training in medical education. Qualitative data were concerning the module implementation perception, time allotted, usefulness, as well as student involvement and assessment methods.

Results

Out of 60 faculty members, 34 submitted their responses through the Google Forum. Most of the participants were females (65%). As shown in [Table 1](#), 50% out of 52.9% of the participants were professors with 5-15 years of service; 53% of faculty members had <14 years of service, and 44% belonged to private and deemed university colleges, respectively. Based on the Likert scale analysis, most participants stated that all the module mentioned for the first professional year were good (40%). Objectives intended for all the modules (40%), teaching-learning methods (40%), time allotted for the module (35%), and assessment methods (40%) were also good ([Figure 1](#)). The median score and interquartile range of the collected data are shown in [Table 2](#).

Table 1. Distribution of the participants’ profile

Variables	Categories	Frequency	Percentage
Age group (years)	< 40	08	23.52
	40 - 49	21	61.76
	50 - 59	03	8.82
	60 & above	02	5.90
Gender	Female	22	64.70
	Male	12	35.30
Length of service (years)	5 - 14	18	52.94
	15 - 24	13	38.23
	25 - 34	01	2.94
	35 & above	02	5.89
Type of institute working	Deemed university	15	44.11
	Public	04	11.78
	Private	15	44.11
Present designation	Assistant professor	06	17.64
	Associate professor	11	32.36
	Professor	17	50.00

Table 2. Measures of the central tendency and standard deviation of the data

	Module I	Module II	Module III	Module IV	Module V
Mean	2.980392	2.946078	3.622549	3.044118	3.362745
Median	3.166667	3.000000	3.833333	3.083333	3.333333
Standard deviation	.7964195	.7562540	.8239970	.6795582	.6349403
Quartiles					
25	2.333333	2.500000	3.333333	2.666667	3.000000
50	3.166667	3.000000	3.833333	3.083333	3.333333
75	3.541667	3.500000	4.208333	3.541667	4.000000

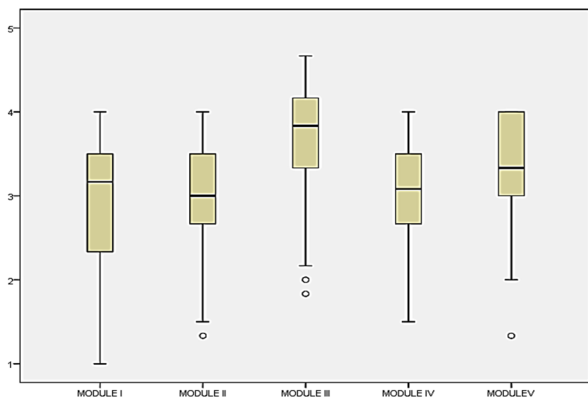


Figure 1. The box plot representation of the five modules

Open-ended responses for the modules: Repetition was avoided in the open-ended responses.

1. Perception regarding implementation of all modules in the first professional year

- a. A very important and basic need for students to learn attitude and communication while treating patients;
- b. Ethics and communication will greatly help in future practices and teaching;
- c. It inculcates a professional attitude among budding physicians;
- d. It guides them to have appropriate behavior and approach toward the patient and society;
- e. Apart from acquiring knowledge, one should know how to approach a patient;
- f. Having good communication is the key to a successful physician.

2. The time duration allotted for each module

- a. Regarding the physician-patient relationship, it can be introduced in the second professional year;
- b. Hectic implementation of all competencies of the five modules in the first professional year;
- c. Only a few hours are required for strengthening the philosophical foundation of humanity’s culture;
- d. Implementing two modules in the first professional year and the other three modules in the second professional year;
- e. It is good, but overlapping topics need to be removed from the foundation course;

- f. It is not much useful to the first-year students;
- g. Modules are good and much needed, as they give a picture of what they can expect once they are involved in patient care.

3. Which module (M) do you think was very useful in the first year?

The majority (80%) of the faculty members mentioned cadaver as their first teacher (1.5 M), followed by the foundation of communication (1.4 M) and what it means by the physician (1.1 M).

4. Comments on the student involvement in conducting this activity

- a. It was very good; the students were very much involved and curious about their responsibilities;
- b. Student involvement was poor. They did not realize its importance;
- c. They are not that active, as topics are a little vague to understand for the first professional year students;
- d. Students are the least interested;
- e. The pandemic was a problem in conducting the activity;
- f. It was an interactive session. They enjoyed it as it was different from usual studies;
- g. They were involved in the debates, role plays, and discussions very enthusiastically;
- h. Involvement was affected by online classes.

5. Comments on the assessment method adopted for the modules

- a. Most of them considered it appropriate, good, and satisfactory;
- b. They are not able to write reflections properly;
- c. It requires further incorporation of assessment tools.

6. Reflection

- a. It is beneficial to have it, as we can start training medicos to develop the Indian Medical Graduate (IMG) guidelines from the first day;
- b. It is important to give them a correct picture of their roles and responsibilities as a physician in the future;
- c. The students understand the importance of teamwork;
- d. Introducing medical students to the dynamics

between physicians, patients, and their relationship should be prioritized at the outset of their training, laying the foundation for a strong professional connection and fostering positive rapport

- e. The AETCOM module will help produce not only highly skilled physicians but also incorporate the true values of professionalism;
- f. The AETCOM module is a longitudinal program to educate the students regarding attitudes, ethics, and communication skills required to be a good physician;
- g. It is taught explicitly using experiential learning, discussions, role plays, and student-oriented learning;
- h. The physician-patient relationship is an essential component in helping students understand the relationship. If the physician conducts these modules, it will enhance the outcomes.
- i. Developing soft skills, professionalism, and ethics needs to be taught from the beginning;
- j. The Cadaver as Teacher module enhances reverence for cadavers.
- k. It will take some time to get mainstream and to change the mindset of faculty members;
- l. Case scenarios are good;
- m. We, as faculty members, also benefitted from and learned newer perspectives on the topic.

7. Any disadvantages of these modules:

- a. The time allotted for each module is a bit much;
- b. All departments must coordinate with each other;
- c. Management in public colleges is not showing interest;
- d. Staff should be trained and a lot of preparation is required;
- e. Some of the modules are too early to be introduced;
- f. All faculty members were not equally enthusiastic. Some lacked training and simply refused to take the classes;
- g. Regarding students, they started presuming that they were already physicians and the seriousness of learning the science for getting the MBBS degree was sometimes lost;
- h. Good assessment methods are required.

8. Do you want to suggest any improvements for these modules?

- a. The modules are fair, best, and well-addressed;
- b. The time duration should be reduced;
- c. The modules must be implemented during the second year;
- d. Case scenarios may be improved;
- e. The AETCOM module taught in the first year should be precise and brief;
- f. Possible improvements should be planned

based on feedback and opinions from stakeholders and teachers;

- g. Communication is almost available in every part of the module, except for the cadaver as a teacher, so it feels like repetition. Hence, some can be incorporated and taken;
- h. Faculty members should get some credit for conducting such classes in terms of points or certification;
- i. All the additional work concerning the CBME is being conveniently getting passed onto the medical education members in the departments;
- j. A team should be created from the first-year faculties.

Discussion

The proposed AETCOM module is a manifestation of understanding that endeavors to strike a balance between the five identified roles of IMGs, viz clinicians, leaders, and the healthcare team members, communicators, lifelong learners, and professional learners, right from their first training professional year. The entire concept of the AETCOM module lies in the fundamental principle that changing an individual's attitude can change his or her behavior. As these new modules are introduced in the CBME curriculum, there is limited available literature associated with the present study regarding AETCOM modules.

According to the feedback responses, the majority of the faculty members stated that it was a good initiative taken by the NMC; similarly, according to Zayapragassarazan Z. *et al.*, it is a really valuable step taken by the Medical Council of India (MCI) to bring changes in the present curriculum (1). This indicates that it is necessary because the AETCOM module is a longitudinal program to train the students regarding attitudes, ethics, and communication skills required to be a good physician. There is a due emphasis on introducing a module on attitude, ethics, and communication skills for medical students from the day they enter medical college (3).

Feedback responses indicate a need for staff training and extensive preparation for implementation; however, management in public colleges shows limited interest. In a study, Modi J.N. *et al.* (4) suggested a lack of training among medical faculty members on designing and implementing the CBME curriculum and a lack of commitment among management to bring changes to the existing system. This shows that accepting and

implementing the new curriculum is a challenging issue in all medical colleges, particularly in public colleges.

Feedback responses also highlight that all faculty members were not equally enthusiastic; some lacked training and simply refused to take the classes. According to Lal S. *et al.* (5), regular sensitization of the learned faculty is essential for the AETCOM core competencies, and one-time training at nodal and regional centers of MCI is not sufficient.

Faculty members also stated that student involvement was poor. They did not realize its importance and were not that active as topics were a little vague to understand for the first professional year students. Various researchers have found that students were not showing keen interest and were exhibiting casual behavior toward this module, and some found that when taught and assessed properly, AETCOM modules were perceived well by students (6, 7), highlighting that the implementation level from faculty members and students is equally responsible.

Some of the faculty members reflected that faculty member should get some credit for conducting such classes in terms of points or certification. Zayapragassarazan Z. *et al.* (1) suggested that incentive mechanisms would also encourage adoption and adaptation to the module. (1) They also commented that it would take some time to get mainstream and to change the mindset of faculty members. Other researchers also believe that the restrained environment of medical colleges leads to difficulties in accepting newer module introductions other than their conventional medical subjects (8-10).

Limitations: The response rate was less and also the representation throughout the country was not present. Hence, observations cannot be generalized.

Conclusion

Based on our study, it can be deduced that the NMC's introduction of the AETCOM module is a commendable initiative. The competencies outlined within each module, emphasizing attitudes, ethics, and communication, are not only commendable but also essential for the current landscape of Indian medical education. These modules play a crucial role in restoring a human touch to the medical profession.

The study indicates that a significant portion of respondents suggested shortening the duration of the modules and reducing redundancy in the communication skills section. It is worth noting that the implementation of the AETCOM module has elicited

diverse reactions from various colleges. In order to enhance the effectiveness of this program, it is imperative to consider the feedback and opinions provided by stakeholders and educators to make necessary improvements.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The study was approved by the competent committee at BLDE of the University, and all procedures were followed in accordance with the rules, regulations, and ethical guidelines that were in force.

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Virtual Image-Based Objective Structured Practical Examination: An Innovative Method of Practical Internal Assessment for Pathology Undergraduate Students During the COVID-19 Pandemic

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Abstract

Background: The covid-19 pandemic has a huge impact on the medical education in India especially the undergraduate medical course. We follow the curriculum based medical education (CBME) as set up by the national medical council in India. Conducting the practical internal assessment for pathology undergraduate students virtually was challenging and we conducted the same using the “Virtual Image based - objective structured practical examination (OSPE)”.

Objectives: To analyze the effectiveness and impact of virtual image based OSPE as a method of internal assessment for pathology undergraduate students during the covid-19 pandemic.

Methods: A total of 198 students took part in the Virtual image based –OSPE pattern of examination. Each OSPE was well structured and had image based questions for 5 marks each. A clinical history was attached with each case and included images of gross morphology and appropriate microscopic pictures. A feedback was taken from the students regarding the image based-OSPE. The feedback included 10 questions assessed on a 5 point Likert scale.

Results: The online image based OSPE was conducted with ease using the online digital software-“jssu online”, successfully simulating the actual offline experience. Answer scripts were uploaded online and the correction was done using the university digital software. The feedback was given by 177 second year MBBS students. The assessment pattern being new and exciting, was received well by majority of the students.

Conclusion: Virtual image based OSPE's are a good substitute for conducting the online practical internal assessment for undergraduate pathology students during the covid-19 pandemic. Especially in universities with a good digital platform, these can be used with ease.

Keywords: Virtual; OSPE; Covid; Digital

Background

The COVID-19 pandemic had a significant impact on medical education in India, particularly the undergraduate medical course. With the suspension of regular classes, many institutes turned to virtual teaching and learning, using various available technologies for both theoretical and practical sessions. The undergraduate medical curriculum in India follows the curriculum-based medical education (CBME) pattern established by the National Medical Council (NMC). Conducting practical internal assessments for

pathology undergraduate students virtually posed a challenge.

One of the practical assessment methods considered for pathology undergraduate students is objective structured practical examination (OSPE). OSPE aims to reduce subjectivity and enhance students' practical knowledge. However, it can be labor-intensive (1-3) and has also been used for formative assessment of students. During the COVID-19 pandemic, our college conducted practical internal assessments virtually using image-based OSPE.

Currently, medical colleges in India conduct practical internal sessions using gross specimens and

microscopic slides, typically involving 5-10 stations, which can be labor-intensive and time-consuming. Virtual OSPE, on the other hand, is a time-saving method that can be conducted for a large number of students simultaneously. It can also include questions related to various topics, such as hematology, blood banking, flow cytometry, special stains, immunohistochemistry, and molecular techniques in practical sessions. Therefore, it can be introduced as a regular method of internal assessment in addition to traditional methods. Furthermore, it can serve as a valuable teaching and learning tool for undergraduate medical students, contributing to the world of technology-based learning in pathology.

Objectives

The study aimed to analyze the effectiveness and impact of virtual image-based OSPE as a method of internal assessment.

Methods

A cross-sectional study was conducted to assess the effectiveness of virtual OSPE after the ethical

committee approval. A total of 177 undergraduate medical students in the second year of their MBBS program participated in the virtual image-based OSPE. Convenient sampling was used as the sampling method, and the students' ages ranged from 19 to 22 years. Among the participants, 52% were females, and 48% were males. Initially, the virtual image-based OSPE was conducted as a "formative assessment-unit test" to familiarize the students with the virtual image-based OSPE format before the practical internal assessment.

Each OSPE was well-structured and had image-based questions for 5 marks each. A clinical history was attached to each case, which included images of gross morphology and appropriate microscopic pictures. OSPEs related to hematology and blood banking included images of peripheral smears, bone marrow aspiration and biopsy, histograms, and images related to special investigations such as osmotic fragility, hemoglobin electrophoresis, and Coombs test. Additionally, images related to blood grouping were also included (Figures 1, 2, 3).



History: A 20 year old male presents with low grade fever, loss of weight, occasional cough and lymphadenopathy. A biopsy of the lymph node is performed.

- a. Describe the gross morphological findings (1 mark).
- b. Describe the microscopic findings (1mark).
- c. After correlating the given history, gross and microscopic findings, what is your diagnosis? (1 mark).
- d. Given below is a special stain that is used to confirm the causative agent in the present case. Identify the stain used.(1mark)
- e. Name two other organs which can be affected by this disease (1mark).

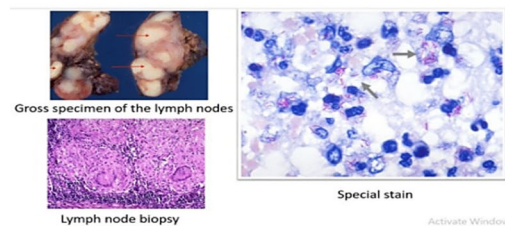


Figure 1: An OSPE created on Tuberculosis

A 40 year old male with history of alcohol abuse had increasing abdominal girth for the past one year. On examination he had yellowish discoloration of his eyes.

A cut section of the liver parenchyma is shown.

- a) Describe the gross morphological features seen (1 mark).
- b) Describe the microscopic features seen (1 mark).

Figure 1 & Figure 2 are microscopic pictures of special stains used in the diagnosis of this disease.

- c) Name the special stains used as seen in Figure 1 and Figure 2 (0.5+0.5marks).
- d) What is the biochemical molecule that has accumulated within the liver? (1 Mark)
- e) Mention any four causes for this pathological change. (1 mark)

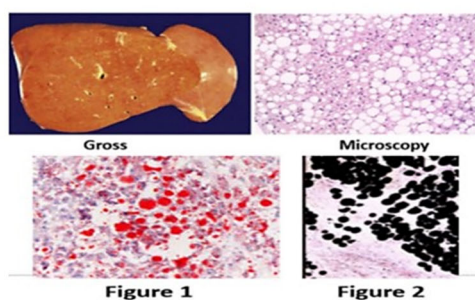


Figure 2: An OSPE created on Fatty change

For each OSPE, students were required to answer approximately 5 to 6 questions based on the provided history and images.

The implementation of the virtual image-based OSPE as an assessment method for the internal evaluation of pathology undergraduate students was facilitated through our university's digital software, "jssu.online." Each image-based OSPE was uploaded to the digital content section of our university's website, where an internal assessment was created. Students were provided with a total of 7 image-based OSPEs to complete, with a time limit of 10 min allocated for each

OSPE. Additionally, a timed PowerPoint presentation of the OSPE was prepared as a backup in case students encountered login issues.

To participate, students were required to log in through the university's website portal and access the internal assessment. Students scanned their answer scripts and uploaded them online. The grading process was also conducted using the university's digital software (Figure 4). Furthermore, students were asked to complete a pre-validated questionnaire, which had been assessed and approved by the medical education unit for virtual image-based OSPE.

A 9 year old child presents with pallor, jaundice and splenomegaly with a family history of jaundice.

- a. Describe the peripheral smear findings(2marks)
- b. What is the diagnosis? Give two points in favour of your diagnosis(2marks)
- c. What is the underlying molecular defect?(2marks)
- d. What type of hemolysis do you see in this condition?(1marks)
- e. Identify the test in the photograph.(1mark)
- f. What are the other confirmatory tests to diagnose this condition.(2marks)

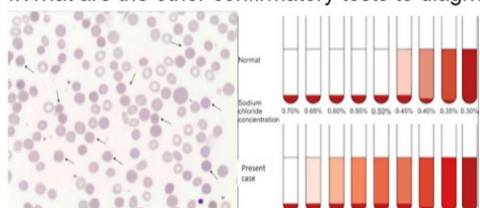


Figure 3: An OSPE created on Hereditary spherocytosis

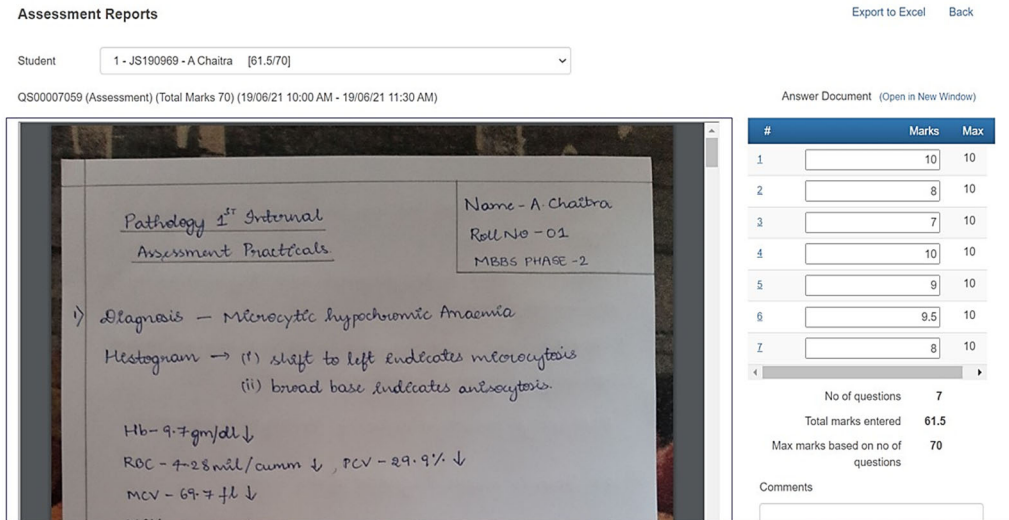


Figure 4: This figure shows assessment of answer scripts with evaluated marks on the right hand side.

This questionnaire included 10 questions and used a 5-point Likert scale for evaluation.

Results

The virtual image-based OSPE was smoothly conducted through the virtual digital software "jssu online," effectively replicating the experience of offline assessments. Feedback on the OSPE was obtained from 177 second-year MBBS students who participated in this novel and engaging assessment method. The students responded positively to the assessment pattern.

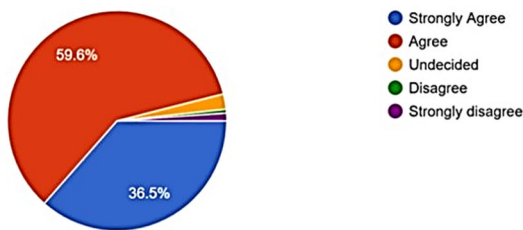
The majority (96.1%) of students agreed that the image-based OSPE was well-structured and logically

sequenced. Additionally, 91.5% of students recognized that relevant questions were posed for each image-based OSPE, and 87% felt that these image-based OSPEs were comprehensive and conceptually sound (Figure 5).

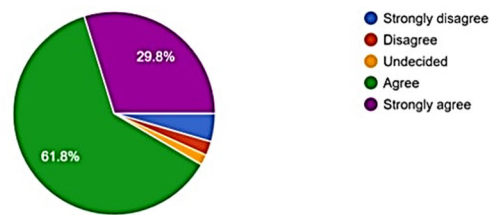
More than 75% of students indicated that all the objectives of laboratory teaching were adequately assessed, and sufficient time was given to answer each image-based OSPE. Furthermore, over 85% of students expressed that OSPE in hematology stimulated their analytical skills (Figure 6).

More than 90% of students believed that image-based OSPEs contributed to improving their clinical knowledge and motivation to learn effectively.

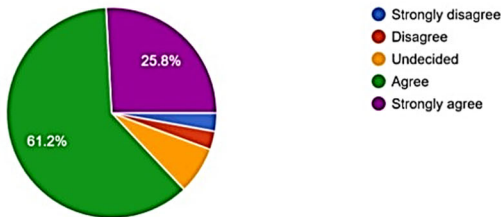
1. Each OSPE was well structured and sequenced.



2. Relevant questions were asked with regard to each image based OSPE.



3. OSPEs were comprehensive and well conceptualized.



4. All the objectives of laboratory teaching were tested.

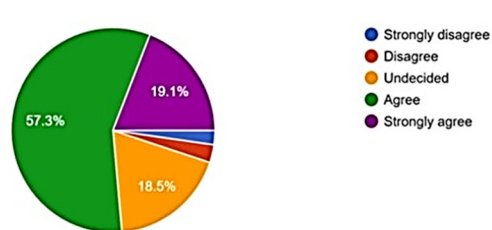


Figure 5: Pie chart showing students opinion for question numbers 1 to 4.

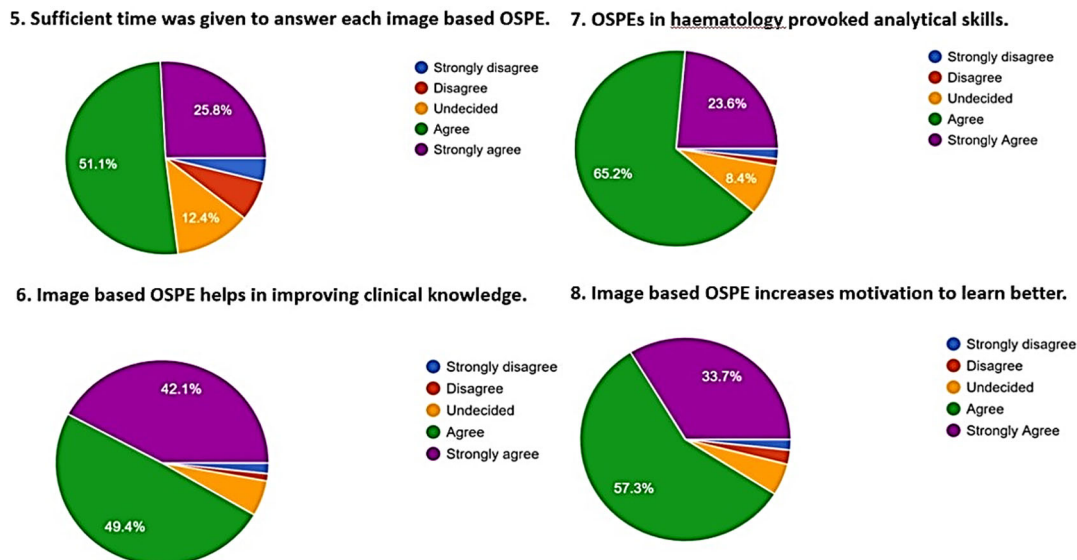


Figure 6: Pie chart showing students opinions for questions numbers 5 to 8

Approximately 70% of students found image-based OSPEs to be less stressful and free from assessment bias. Specifically, 70.8% of students agreed that image-based OSPEs were less stressful and eliminated bias in assessment (Figure 7).

Discussion

The concept of OSPE was introduced in 1975 and later expanded to encompass practical examinations, undergoing modifications by Harden and Gleeson (1, 2). OSPE proves to be a reliable assessment tool capable of distinguishing between various categories of students effectively. Students can apply their knowledge to solve practical case scenarios, making it superior in these aspects compared to traditional practical examinations. Furthermore, OSPE can be structured to comprehensively assess all the objectives of laboratory

teaching, assigning appropriate weightage to each aspect (3-5).

OSPE focuses on the "shows how" aspect of Miller's pyramid of competence, concentrating on evaluating the performance of specific skills in a controlled setting. This focus enhances reliability and validity, making it an impartial method of assessment, as all candidates are presented with the same task.

While the examination of pathology slides through a microscope and the observation of gross morphology with the naked eye remain irreplaceable, there are circumstances, such as the COVID-19 pandemic, where virtual image-based OSPEs can serve as a viable substitute for practical internal assessments (4, 5). Despite this potential, no studies have investigated virtual image-based OSPEs in pathology during the COVID-19 pandemic.

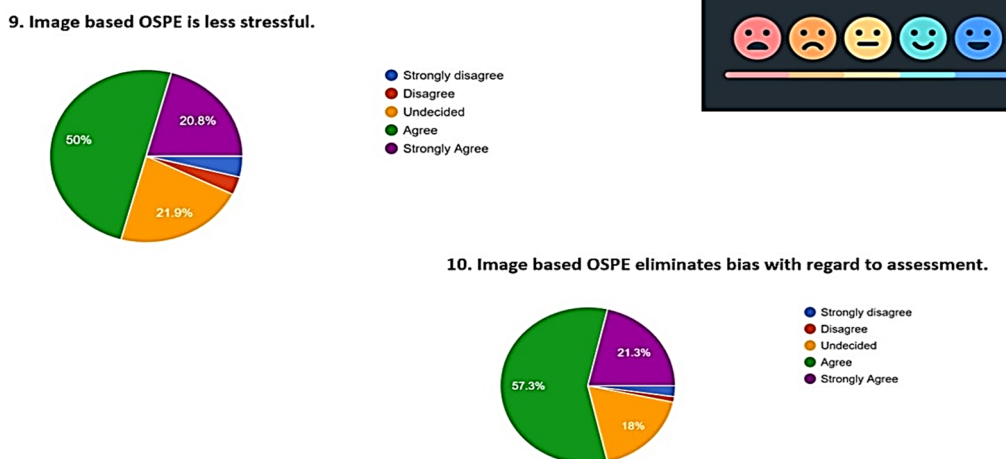


Figure 7: Pie chart showing students opinions for questions number 9 and 10.

Vishwanathan K et al conducted a study evaluating the perception of medical undergraduate students regarding electronic OSPEs in orthopedics during the COVID-19 pandemic (1). Their study received a positive response from students, similar to the findings of the present study, establishing a favorable perception of the new examination technique employed in orthopedics during the COVID-19 pandemic (1).

The ease of conducting electronic OSPE in pathology can be attributed to the digitalization of entire microscopic slides. Creating image-based questions related to gross morphology, including pictures of routine hematoxylin and eosin staining microscopy, as well as special stains, can be done with ease. Additionally, images of peripheral blood smears, bone marrow aspiration and biopsy, immunohistochemistry, certain molecular techniques (eg, fluorescence in situ hybridization [FISH]), and special tests (eg, Coombs test and sickling test) can prove highly useful in formulating OSPE questions.

Some studies have used a combination of Google Classroom with a Google Form-based online assessment system to develop electronic OSPEs. Dutta, Atanu Kumar et al designed a single Google sheet linked to all stations, allowing for time limits at each station and proceeding to the next station only after submission of answers for the present station. The entire process was also monitored using Google Classroom's live stream during the examination (5-7).

The COVID-19 pandemic has significantly tested our technology skills. On a positive note, it has prompted the adoption of numerous innovative online teaching and learning methodologies, with virtual image-based OSPE being one of them. Many institutes in India struggled to conduct practical internal assessments in a structured manner during the COVID-19 pandemic (8, 9). However, virtual image-based OSPE can be easily implemented in institutes with good technology infrastructure, even during the non-COVID era. Virtual simulation is another newly emerging interactive pedagogical strategy in the field of undergraduate medical education (9, 10).

Nevertheless, certain drawbacks are associated with monitoring students during virtual examinations. These issues can be mitigated by using technology-based applications like Zoom or Google Classroom. A video link can be sent to students along with the internal assessment to monitor their activities. However, this approach may be labor-intensive, especially when dealing with large batches of students numbering over

100. It could be challenging for faculty members to virtually monitor such a large group of students simultaneously.

Conclusion

Virtual image-based OSPEs proved to be a suitable alternative for conducting virtual practical internal assessments for undergraduate pathology students during the COVID-19 pandemic. This approach can continue to be valuable, particularly in universities with robust digital platforms, even beyond the COVID era. Creating timed PowerPoint presentations for these image-based OSPEs and administering them through various digital platforms is a feasible option.

The OSPEs effectively replicated practical exercises, and although students could not physically perform the experiments, the questions were designed around the underlying concepts and principles. This approach greatly contributed to enhancing their clinical knowledge and understanding of applications. It can be integrated as an additional exercise alongside routine undergraduate practical classes, even after the COVID-19 pandemic, especially for exercises that can be learned without actually performing them.

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Empowering the Healers: Strengthening Self-Efficacy and Learning Environment in Boosting Academic Resilience

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Abstract

The journey of medical students can prove to be extremely challenging and tough owing to academic pressures, parental expectations, peer pressure, and students' inability to adapt to the environment in a medical school. Academic resilience among medical students refers to their ability to persevere, adjust, and sustain encouraging learning outcomes despite the challenges, obstacles, and varied stressors they encounter during their period of undergraduate training. Self-efficacy can be regarded as one of the key factors in strengthening academic resilience, and accordingly, we must take specific measures to develop and improve the same among them. The learning environment in a medical school significantly impacts and determines the academic resilience levels of medical students. In conclusion, acknowledging the challenges and problems that medical students have to experience during their undergraduate training period, it is quite essential that specific measures be taken to augment the academic resilience among medical students. The need of the hour is to adopt a comprehensive approach that addresses self-efficacy and the learning environment simultaneously and helps them promote their overall well-being and academic success.

Keywords: Academic Resilience; Self-Efficacy; Learning Environment; Medical Students; Medical Education

Background

The journey of medical students can prove to be extremely challenging and tough owing to academic pressures, parental expectations, peer pressure, and students' inability to adapt to the environment in a medical school (1). Academic resilience among medical students refers to their ability to persevere, adjust, and sustain encouraging learning outcomes despite the challenges, obstacles, and varied stressors they encounter during their undergraduate training period (1, 2). In other words, it means acquiring desired skills, developing specific attitudes, and adopting relevant strategies to overcome potential obstacles, and thereby learn the art of thriving academically (2,3).

Significance and Need for Academic Resilience: In the context of medical students, academic resilience is of paramount importance, as each student must find their

own way to stay on track to meet the targets of subject-specific competencies within the given time frame (1, 2). In general, a medical student is subjected to a challenging curriculum with high academic demands (i.e., vast syllabus, complex concepts, multiple competencies that need to be acquired in different learning domains, non-cognitive attributes, rigorous assessments, patient care, etc.), and this justifies the need for developing academic resilience that will help them cope with the demanding workload and sustain their academic performance (3, 4). Moreover, as the duration of training is quite long-lasting for many years, students must have academic resilience, which will keep them motivated to learn and grow throughout (5). Academic resilience plays a defining role in managing high levels of stress, maintaining well-being, effectively handling

pressure, and performing better in high-stakes examinations (4).

Academic resilience also motivates students to engage in the process of continuous lifelong learning, as the branch of medicine continues to change every day (2). In other words, it plays an instrumental role in shaping the professional development of medical students, including the self-reflection ability (6). At the same time, academic resilience helps students develop critical thinking and problem-solving skills while dealing with real-life situations in hospital settings and thus make more sound clinical decisions, and provide high-quality care to the patients (7). It also empowers students to deal effectively with emotional challenges (viz. ethical dilemmas, patient sufferings, and handling difficult conversations in special circumstances), without letting their studies be affected. Further, we can say that all these applications of academic resilience enable students to prioritize and manage their time effectively, which in turn enables them to maintain a balance between personal and professional lives (6, 7). All these factors cumulatively highlight the importance of academic resilience among medical students in maintaining their personal well-being, academic success, and future professional practice (6, 7).

Self-Efficacy and Academic Resilience: In simple terms, self-efficacy refers to the self-belief that an individual has in their ability to meet the assigned tasks by overcoming different challenges (8). Self-efficacy can be regarded as one of the key factors in strengthening academic resilience, as students with high self-efficacy consider challenges as opportunities for growth rather than impediments (8, 9). Furthermore, medical students with high self-efficacy tend to have high motivation to engage in academic activities, possess the ability to bounce back from failures, and have more belief to succeed regardless of prior negative outcomes (8, 10). Moreover, students tend to demonstrate more determination and participate in effective problem-solving strategies when they are subjected to academic difficulties (10, 11). In addition, students with high self-efficacy will have better control over their learning outcomes, as they will be proactive and seek guidance from teachers and their peers whenever they face obstacles (11).

In continuation, self-efficacy also has an impact on the students' emotional well-being and confidence level and enables them to handle stress and academic pressure with a positive mindset (12). Also, these students know

the art of self-regulation and thus are more equipped to set realistic goals, plan effectively, monitor their progress, and adapt learning strategies to meet the set goals, which in turn augments their academic resilience (13). Further, self-efficacy nurtures a growth mindset, wherein the students believe that if they make an effort and practice more, they can improve their overall intelligence (11, 13). In addition, students with better self-efficacy tend to accept and attribute their success and failure to their individual actions, instead of blaming others (2-4). In short, students with high self-efficacy generally adopt a positive outlook on things happening around them and take proactive measures to thrive and excel on the academic front (2, 8, 13).

Strategies to Augment Self-Efficacy: The above discussion clearly justifies the role of self-efficacy in improving academic resilience among medical students, and accordingly, we must take specific measures to develop and improve the same among them (1, 2). This has to begin with providing an ample number of opportunities where students can experience success in their academic activities, and these activities can be gradually made more difficult (7, 8, 14). The next strategy is to provide the students with specific and constructive feedback about the things at which students are good and the domains that need improvement (1). The feedback should be given to encourage self-reflection and motivate students to take the onus of their learning by setting realistic learning goals (2). Another strategy will be to expose students to good role models, who can inspire students to put in more effort and demonstrate determination to succeed in their set goals (2).

The institution can strengthen its mentorship program, wherein teachers can guide and support students in their individual areas of weakness (15). At the same time, mentors can encourage students to set realistic targets that can be accomplished by them and that will make them more confident and believe in their abilities (12, 15). Further, mentors can also discuss with students about their past accomplishments and make them believe that if things can happen in the past, the same things can be achieved in the present and the future (15). Moreover, students can be encouraged to prepare a study routine that suits their learning styles and gives them an opportunity to maintain a balance between academics and personal life (16). At this stage, we must remember that it is extremely crucial that we celebrate

the small milestones and motivate students to enjoy the learning process, helping them improve their self-efficacy, which in turn will augment their academic resilience.

In addition, students can be sensitized on effective study techniques, time management, and organization skills (viz. breaking down complex tasks into smaller, manageable steps); all these initiatives will help students handle the academic workload effectively (17). It is always a good move to establish a supportive learning environment, wherein students can come forward to share their views without having the fear of being judged (18). In this regard, teachers can take measures to facilitate peer learning and collaboration between students to help them learn from each other and also improve their confidence levels (12, 19). By ensuring the implementation of these measures, we can cultivate self-efficacy and augment the academic resilience of students, which will enable them to traverse through the challenges during their undergraduate period (16-18).

Learning Environment and Academic Resilience: The learning environment in a medical school significantly impacts and determines the academic resilience levels of medical students (20). The presence of an inclusive learning environment gives a feeling of belonging and once students know that they are supported and their contributions are acknowledged, they show more drive and energy to deal with potential setbacks (20, 21). In fact, once a student knows that their learning environment is culturally inclusive, wherein their opinions are valued regardless of the geographical and socio-demographic attributes, there is a significantly higher level of academic resilience among them (20, 21). The presence of an engaging learning environment ensures that students actively participate in classroom learning activities and have better motivation to be productive (22).

Further, the organization of collaborative learning activities (such as group projects) promotes students' teamwork, critical thinking, problem-solving, and decision-making skills, enhancing academic resilience cumulatively (23). In continuation, opportunities for experiential learning expose students to real-world contexts and enable students to apply their knowledge (7, 18, 23). Additionally, the presence of a well-designed curriculum that provides an appropriate platform for students, where they can build upon their knowledge and skills gradually, is crucial in augmenting academic resilience (23). Moreover, the provision of a flexible learning environment aids students with different

learning styles and learning needs to actively participate in learning activities. In addition, the provision of a well-maintained physical learning space will also play its role in improving the overall academic resilience (18).

The presence of knowledgeable and skilled faculty members in the college also improves the learning environment, which in turn promotes confidence and resilience among students. These faculty members apart from teaching, play a defining role in mentoring, guiding, coaching, and providing constructive feedback to the students about their learning progress (15). Further, encouragement of reflection and self-assessment within the learning environment promotes the development of metacognition skills and self-regulation, which are crucial in the development of academic resilience (2). Moreover, once students have easy access to learning resources (viz. textbooks, articles, research materials, technology, etc.), they remain abreast with relevant and recent information, which is quite essential to overcome academic challenges (24, 25). The various aspects of the learning environment that can influence academic resilience have been demonstrated in Figure 1.

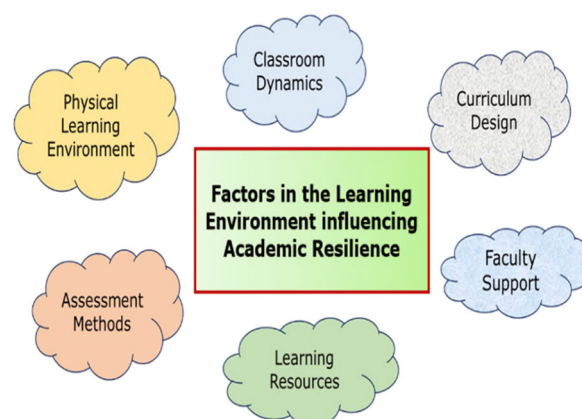


Figure 1: Factors in the learning environment influencing academic resilience

Strategies to Create an Optimal Learning Environment in Order to Promote Academic Resilience:

After considering the relationship between the learning environment and the development of academic resilience, we must necessarily take measures to improve the same (26, 27). In fact, several strategies can be tried to strengthen the learning environment, starting from establishing a culture of respect, empathy, and support in the institution, by devising policies that encourage both inclusivity and diversity among students as well as teachers (20, 21). The next approach is to organize

multiple faculty development programs to strengthen and refine their mentoring and feedback delivery skills (15). From the student's perspective, we have to initiate different supportive services (viz. mentorship, career guidance, counseling, coaching, etc.) that will play a defining role in improving their well-being (28, 29).

The medical curriculum should have a mix of theory and practical learning experiences, which must be delivered with the help of active learning strategies (viz. simulation, problem-based learning, group projects, etc.) (18, 22, 24). Students should be given opportunities to get engaged in research projects, experiential learning, and community-based learning, as all of them will help the students acquire a wide range of competencies (7, 30). In addition, they should be given access to a wide range of recommended learning resources and technology to help them feel supported (24, 25, 31). We can also initiate a buddy system, wherein seniors can guide junior students in academic matters and share their experiences (19). In addition, we must develop a system to recognize and celebrate the achievements of students, which will motivate them to continue the good work and feel confident as well. Teachers should be encouraged to cultivate resilience among students, and a feedback mechanism should be established in the institution, wherein both teachers and students are given constructive feedback on a regular basis (1, 15).

Conclusion

In conclusion, acknowledging the challenges and problems that medical students have to experience during their undergraduate training period, it is quite essential that specific measures be taken to augment the academic resilience among medical students. The need of the hour is to adopt a comprehensive approach that addresses self-efficacy and the learning environment simultaneously, helping them promote their overall well-being and academic success.

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Developing and Validating an Assessment Blueprint for Clinical Skill Competencies in Dermatology, Venereology, and Leprosy for Phase II and Phase III Medical Students

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Abstract

Background: The assessment blueprint is a calibrated dossier, which is a meticulously designed document that proactively compiles all educational content and its anticipated outcomes comprehensively. This blueprint is a powerful tool that integrates subject matter, learning objectives (including skills, knowledge, and attitude), tools, and methods to assess the content.

Objectives: The primary goal of this study was to develop a blueprint for clinical skill competencies within the Department of Dermatology, Venereology, and Leprosy (DVL) for medical undergraduates at the Apollo Institute of Medical Sciences and Research (AIMSR) in Hyderabad, India.

Methods: The faculty of DVL and the curriculum coordinator developed a blueprint for the mentioned department at AIMSR in collaboration with Gandhi and Osmania Medical College. Faculty members provided feedback on the blueprint.

Results: The feedback results are presented in terms of percentages. Notably, 70% of the faculty members expressed the view that blueprint assessments enhance the validity of assessments and appropriately assign weightage to topics of public health significance.

Conclusion: Incorporating blueprints into both summative and formative assessments enhances quality, validity, and reliability. It represents one of the most acceptable approaches for medical students to balance learning and practical application of concepts.

Keywords: Blueprint, DVL, Medical Education, Competency Based Medical Education, Clinical Skills

Background

Assessment plays a pivotal role in all educational programs, particularly in the realm of medical education. This process is complex, involving a diverse array of tools and methods employed by assessors to evaluate, measure, and document the academic readiness and skill acquisition of medical graduates. In India, medical education has traditionally adhered to conventional assessment methods, relying on a limited

number of structured clinical cases. This approach can be inadequate and subjective (1, 2), potentially negatively impacting students' learning abilities and, by extension, public health outcomes. Therefore, there is a pressing need for a robust and revised evaluation system.

The assessment blueprint is a meticulously crafted document designed prospectively to comprehensively compile all of the educational content and its anticipated outcomes. Its purpose is to ensure the assessment

process encompasses all aspects of the curriculum and their respective domains. Presently, various assessment methods are employed, including short-case and long-case assessments, logbooks, audits, simulated patient surgeries and procedures, video assessments, simulators, and standardized patients (3). Using multiple assessment methods is imperative to cover the most crucial aspects of clinical competency. It has been recognized that relying solely on a single method would be insufficient to help students grasp and acquire skill-based knowledge.

The blueprint represents a highly efficient tool that seamlessly integrates subject content, learning objectives (including skills, knowledge, and attitude), tools, and methods necessary for assessing the content. Currently, it stands as the gold standard for evaluation, facilitating fair assessments by offering clear guidelines to students (4).

This study was conducted to develop an assessment blueprint for clinical skill competencies among undergraduates in the Department of Dermatology, Venereology, and Leprosy (DVL). Additionally, it seeks to analyse faculty perceptions regarding this blueprint.

Objectives

The primary objective of the present study was to develop a blueprint for assessing clinical skill competencies within the DVL department for medical students enrolled at the Apollo Institute of Medical Sciences and Research (AIMSR) in Hyderabad, India. This study aims to enhance medical education for undergraduates through the creation of standardized assessment methods and the validation of these methods by soliciting feedback from subject experts.

Methods

The faculty members from the DVL department at 3 medical schools, namely AIMSR, Osmania Medical College, and Gandhi Medical College, along with the curriculum coordinator from AIMSR, participated in the development of the blueprint. This cross-sectional study was done over 1 year. Since 2019, nearly all Indian

medical schools have initiated the implementation of a competency-based curriculum as proposed by India's National Medical Council (NMC). The curriculum comprises 3 phases: pre-clinical, para-clinical, and clinical phases, with dermatology (DVL) falling under the phase 3 clinical subject category.

As part of the Early Clinical Exposure (ECE) module in Competency-Based Medical Education (CBME), medical students during their course undergo 45 days of clinical postings in the DVL department, with 15 days each allocated to phase II, part 1 of phase III, and part 2 of phase III. Table 1 provides the details of the competency content, while a step-by-step description of how the blueprint was formulated can be found in Figure 1.

Blueprint Planning: This blueprint was developed to evaluate the clinical competencies of medical students during clinical postings in the DVL department (from phase 2 to phase 3) at AIMSR, Hyderabad.

Sensitization Workshop

The DVL faculty was sensitized by the Institutional Medical Education Unit on Competency-based medical education and the significance of blueprinting in medical education, including both teaching and assessments. The blueprint includes all the recommended competencies, along with well-defined learning objectives, teaching and learning methods, and assessment details.

A total of 10 subject experts from 3 medical colleges (3 of whom are heads of the departments, 1 is a professor, 1 is an associate professor, 4 are assistant professors, and 1 is a senior resident) participated in the development of the blueprint in coordination with the curriculum coordinator. The process is explained in 3 steps as follows.

Step 1: All competencies covering the syllabus included in phases II and III of MBBS were reviewed by the subject experts. First, the learning objectives were formulated, followed by the design of teaching/learning (T/L) methods and assessment tools for each competency.

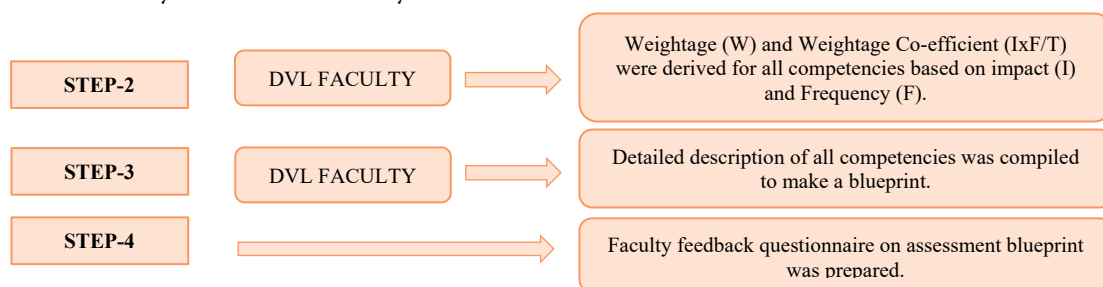


Figure 1. Flowchart to explain the methodology

Table 1. Final Blueprint for Dermatology, Venereology, and Leprosy for Clinical Assessment for Medical Undergraduates

Competency - TOPIC	T/L - method	Impact (I)	Frequency of occurrence (F)	I × F	W = Ix F/T	Total marks (100)	No. of questions = W x 45	Rounding off (culminate closer to the next value)	OSCE	MCQ (1Mark)	Phase 2	Phase 3 (part1)	Phase 3 (part 2)
Identify and grade various types of acne	Bedside clinic	1	3	3	0.04	4	1.8	2	1 (3M)	1	✓		✓
Identify and differentiate vitiligo from other causes of hypopigmented lesions	Bedside clinic, SNAPPS	2	2	4	0.05	5	2.25	2	1 (4M)	1	✓	✓	
Identify and distinguish psoriatic lesions from other causes	Bedside clinic, SNAPPS	2	2	4	0.05	5	2.25	2	1 (4M)	1	✓	✓	✓
Demonstrate the Grattage test	DOAP	2	3	6	0.07	7	3.15	3	1 (5M)	2	✓	✓	✓
Identify and distinguish lichen planus lesions from other causes	Bedside clinic, SNAPPS	1	2	2	0.02	2	0.9	2	0	2			✓
Identify and differentiate scabies from other lesions in adults and children	Bedside clinic, SNAPPS	2	3	6	0.07	7	3.15	3	1 (5M)	2	✓	✓	
Identify and differentiate pediculosis from other skin lesions in adults and children	Bedside clinic	1	2	2	0.02	2	0.9	1	1 (2M)	0	✓	✓	
Identify candida species in fungal scrapings and KOH mount	DOAP	1	3	3	0.04	4	1.8	2	2 (2M)	0	✓		
Identify and distinguish herpes simplex and herpes labialis from other skin lesions	Bedside clinic	2	3	6	0.07	7	3.15	3	1 (5M)	2		✓	
Identify and distinguish herpes zoster and varicella from other skin lesions	Bedside clinic	2	3	6	0.07	7	3.15	3	1 (5M)	2	✓	✓	

Identify and distinguish viral warts from other skin lesions	Bedside clinic, DOAP	2	3	6	0.07	7	3.15	3	1 (5M)	2	✓		✓
Identify and distinguish molluscum contagiosum from other skin lesions	Bedside clinic, DOAP	1	3	3	0.04	4	1.8	2	1 (3M)	1	✓		✓
Enumerate the indications, describe the procedure, and perform a Tzanck smear	DOAP	1	2	2	0.02	2	0.9	1	1 (2M)	0	✓		✓
Demonstrate and classify based on the clinical features of leprosy, including an appropriate neurologic examination	Bedside clinic, DOAP	3	2	6	0.07	7	3.15	3	1 (5M)	2	✓	✓	✓
Enumerate the indications and observe the performance of a slit skin smear in patients with leprosy	Bedside clinic, DOAP	3	2	6	0.07	7	3.15	3	1 (5M)	2			✓
Identify and classify syphilis based on the presentation and clinical manifestations	Bedside clinic	2	2	4	0.05	5	2.25	2	1 (4M)	1	✓	✓	
Identify spirochete in a dark ground microscopy/VDRL	DOAP	3	2	6	0.07	7	3.15	3	1 (5M)	2	✓	✓	
Counsel in a non-judgemental and empathetic manner to patients on the prevention of sexually transmitted disease	Role-play, DOAP	3	3	9	0.11	11	4.95	5	3 (3M)	2	✓	✓	✓

DOAP: Demonstrate, observe, assist perform; OSCE: Objective structured clinical examination; T/L: Teaching/Learning; SNAPPS: summarize, narrow, analyze, probe, plan, and select

Step 2: The weightage for each competency was determined based on 2 parameters: first, the impact of the topic on health (I), and second, its frequency of occurrence (F).

Perceived impact (I) of the topics on health were categorized under one of the following:

1) Non-urgent, 2) serious but not life-threatening, and 3) life-threatening emergency.

The frequency (F) of occurrence of a particular disease was categorized under the following:

1) Rarely seen, 2) relatively common, and 3) very common.

Based on the $I \times F$, the topics were classified as "must know" with $I \times F$ 6-9, "should know" with $I \times F$ of 3-4, and "good to know" with $I \times F$ of 1-2.

The weightage coefficient for each competency was calculated as $I \times F / T$. The sum of I and F is labelled as T. The number of questions for each competency was calculated by multiplying the weightage coefficient by the total number of items in the assessment. The total marks for each topic were calculated by multiplying the corresponding value of weightage (W) by the total marks assigned to the students according to the blueprint.

Step 3: Contents of Blueprint: Each competency was described in detail to ensure that the medical student is adequately trained and assessed to meet the minimum required level. Table 2 provides details about the division of competencies included in the blueprint. The assessments were divided into objective structured clinical examination (OSCE) and case-based discussion. Furthermore, OSCE was subdivided into history taking, physical examination, clinical procedure, clinical reasoning, and communication skills.

Step 4: Feedback: In this step, a faculty feedback questionnaire was prepared to obtain the opinions and expertise of the faculty regarding the assessment blueprint. The questionnaire underwent peer review and was further validated by the medical education unit's team. The feedback form was constructed with validated standard questions to gather a valid and accurate perception of the faculty's views, which would assist in evaluating the significant role of the blueprint and its necessity in assessing the clinical skills of medical students. Data analysis was conducted using SPSS version 20.0.

The faculty's perceptions were graded using a 5-point Likert scale. To measure the reliability of the faculty feedback, the Cronbach's alpha test was used. According to SPSS, if the score is $\alpha < 0.5$, it is considered

unacceptable; $\alpha \geq 0.5$ is poor; $\alpha \geq 0.6$ is questionable; $\alpha \geq 0.7$ is acceptable; $\alpha \geq 0.8$ is good, and $\alpha \geq 0.9$ is excellent (5). The obtained value was $\alpha = 0.874$, which is considered good based on the rule of thumb for results.

Results

Table 3 provides details about the number of competencies, including all those suggested by the NMC as per the revised curriculum. The assessment pattern includes OSCE and multiple-choice questions (MCQs), covering phases II and III (part 1 and part 2). These competencies can be taught and assessed in either one phase or multiple phases. The table is enriched with comprehensive information regarding all the included competencies, their alignment with T/L methods, the phase of assessment, and the suitable assessment format. Additionally, the table offers specifics about the allotted marks for each competency, which are determined based on the impact score and the frequency of application of specified competencies in clinical practices.

Table 4 presents information about the curriculum contents, which are the product of $I \times F$ and categorized as knows, including Must know (MK), Should Know (SK) and Good to Know (GK). In the present study, 50% of the competencies fall under must know, 33.3% fall under should know, and 16.7% fall under good to know. This table can serve as a template for assessors, assisting them in selecting the competencies for assessment.

The faculty feedback form was employed to gather the opinions of the subject experts on the designed blueprint, as depicted in Figure 2. The results of the feedback form are presented in terms of percentages. Among the findings, 70% of the faculty expressed the view that blueprint assessment enhances the validity of assessments, and they appreciated the allocation of proper weightage to topics related to public health importance. Additionally, 60% of the faculty participants conveyed that blueprinting contributes to fairness in assessment, as it ensures the equitable distribution of questions across all significant topics. They also noted that the blueprint serves as a valuable guide for constructing clinical exams.

Discussion

A blueprint serves as a map that precisely defines the content of assessments. It has been proven to be advantageous in the successful implementation of the curriculum and assessments.

Table 2. Best Suitable Method for Assessing Clinical Skills in DVL

Competency number	Competency topic	History taking	Physical examination	Clinical procedure	Clinical reasoning	Communication skills	MCQs
DR 1.2	Identify and grade various types of acne		✓		✓		✓
DR 2.1	Identify and differentiate vitiligo from other causes of hypopigmented lesions	✓	✓		✓		✓
DR 3.1	Identify and distinguish psoriatic lesions from other causes	✓	✓	✓			✓
DR 3.2	Demonstrate the Grattage test			✓			✓
DR 4.1	Identify and distinguish lichen planus lesions from other causes	✓	✓		✓		✓
DR 5.2	Identify and differentiate scabies from other lesions in adults and children	✓	✓		✓		✓
DR 6.2	Identify and differentiate pediculosis from other skin lesions in adults and children		✓		✓		
DR 7.2	Identify candida species in fungal scrapings and KOH mount			✓			
DR 8.2	Identify and distinguish herpes simplex and herpes labialis from other skin lesions	✓	✓	✓			✓
DR 8.3	Identify and distinguish herpes zoster and varicella from other skin lesions	✓	✓	✓			✓
DR 8.4	Identify and distinguish viral warts from other skin lesions		✓	✓			✓
DR 8.5	Identify and distinguish molluscum contagiosum from other skin lesions		✓	✓			✓
DR 8.6	Enumerate the indications, describe the procedure, and perform a Tzanck smear			✓			
DR 9.2	Demonstrate and classify based on the clinical features of leprosy, including an appropriate neurologic examination		✓	✓	✓		✓
DR 9.3	Enumerate the indications and observe the performance of a slit skin smear in patients with leprosy			✓			✓
DR 10.1	Identify and classify syphilis based on the presentation and clinical manifestations	✓	✓		✓		✓
DR 10.2	Identify spirochete in a dark ground microscopy/VDRL				✓		✓
DR 10.5	Counsel in a non-judgemental and empathetic manner to patients on the prevention of sexually transmitted disease				✓	✓	✓

Table 3. Best Suitable Method for Assessing Clinical Skills in DVL

Competency number	Competency topic	OSCE (number in the bracket represents marks)	MCQs (1 mark each)	Total marks (100)
1.2	Identify and grade various types of acne	1 (3M)	1	4
2.1	Identify and differentiate vitiligo from other causes of hypopigmented lesions	1 (4M)	1	5
3.1	Identify and distinguish psoriatic lesions from other causes	1 (4M)	1	5
3.2	Demonstrate the Grattage test	1 (5M)	2	7
4.1	Identify and distinguish lichen planus lesions from other causes	0	2	2
5.2	Identify and differentiate scabies from other lesions in adults and children	1 (5M)	2	7
6.2	Identify and differentiate pediculosis from other skin lesions in adults and children	1 (2M)	0	2
7.2	Identify candida species in fungal scrapings and KOH mount	2 (2M)	0	4
8.2	Identify and distinguish herpes simplex and herpes labialis from other skin lesions	1 (5M)	2	7
8.3	Identify and distinguish herpes zoster and varicella from other skin lesions	1 (5M)	2	7
8.4	Identify and distinguish viral warts from other skin lesions	1 (5M)	2	7
8.5	Identify and distinguish molluscum contagiosum from other skin lesions	1 (3M)	1	4
8.6	Enumerate the indications, describe the procedure, and perform a Tzanck smear	1 (2M)	0	2
9.2	Demonstrate and classify based on the clinical features of leprosy, including an appropriate neurologic examination	1 (5M)	2	7
9.3	Enumerate the indications and observe the performance of a slit skin smear in patients with leprosy	1 (5M)	2	7
10.1	Identify and classify syphilis based on the presentation and clinical manifestations	1 (4M)	1	5
10.2	Identify spirochete in a dark ground microscopy/VDRL	1 (5M)	2	7
10.5	Counsel in a non-judgemental and empathetic manner to patients on the prevention of sexually transmitted disease	3 (3M)	2	11

Table 4. Categorization of Competencies with Phase-Wise Teaching

I x F	Category	%	Phases		
			Phase 2	Phase 3 (part 1)	Phase 3 (part 2)
6 - 9	Must know	50	7	7	5
3 - 4	Should know	33.3	6	2	3
1 - 2	Good to know	16.7	2	1	2
Total		100			

It aids in assigning appropriate weightage to all competencies, ensuring comprehensive coverage of the syllabus for individual subjects and phases of learning. The primary objective of the present study was to develop a blueprint for the DVL subject to assess second and third-year medical undergraduate students. The study aimed to include both topic-based and

competency-based questions with credible weightage, covering all subject topics in accordance with NMC guidelines.

The developed blueprint was then presented to subject experts, and their valuable feedback on the blueprint design was obtained, as detailed in the results section.

Most previous literature on blueprint development and implementation has highlighted the advantages of blueprints in teaching and assessing medical subjects, which aligns with the outcomes of our study. A study conducted by Sunita et al in 2015 evaluating blueprints and their implementation showed that approximately 89% of the faculty believed that blueprints contribute to fair evaluation and assist in aligning assessment objectives. They also share the same opinion as our study that blueprinting should be an integral part of any type of assessment, whether formative, summative, or final assessment (6).

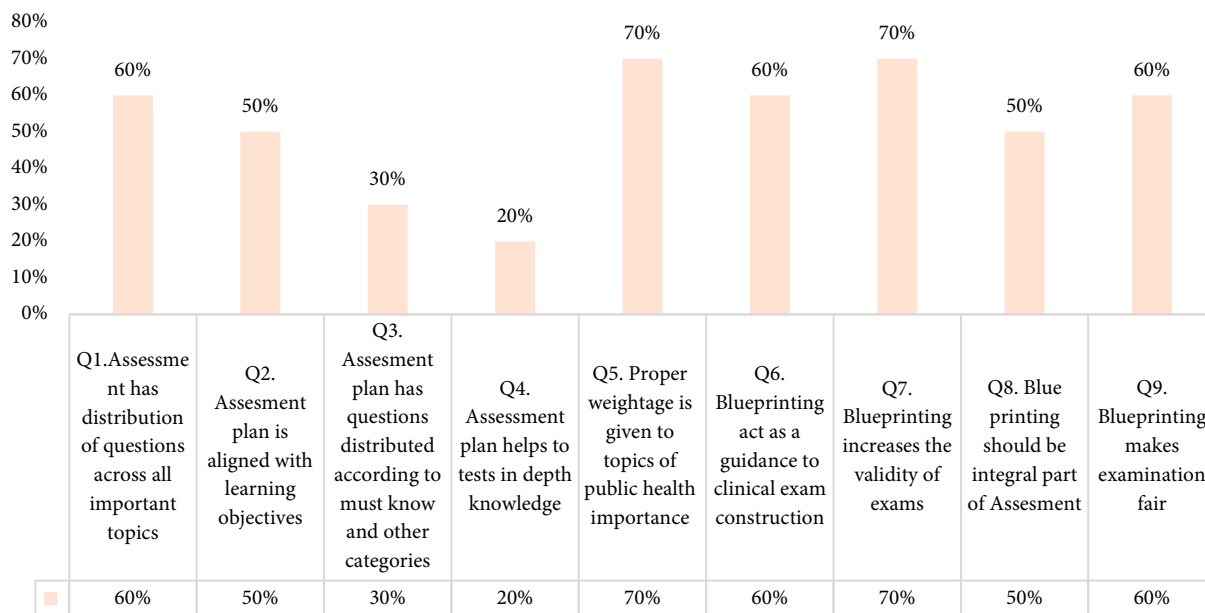


Figure 2. Measures of the faculty feedback form

The blueprint serves as a guide for planning and constructing questions from eligible chapters, ensuring that the required weightage is given to various competencies within a specific subject. It is a clear, fair, explicit, and transparent assessment tool that guides students on the right path of learning and acquiring the desired knowledge, which can further enhance their clinical skills in terms of observation, analysis, and implementation (6-8). The use of the blueprint makes assessments more meaningful by directing students toward evidence-based learning.

Furthermore, implementing this blueprint in the second and third academic years of medical undergraduates and gathering feedback from the students on its effectiveness can help establish a high-quality assessment tool (blueprint) for the DVL subject.

Limitations: There are certain limitations in our study. First, the validation of the blueprint is subjective, which may introduce some degree of bias. Additionally, we did not collect student feedback, which could have provided valuable insights into their perception of the assessment process.

Conclusion

Using a blueprint in assessments both for summative and formative purposes, enhances the quality, validity, and reliability of the assessment process. It is widely accepted and contributes to a balanced approach to learning and implementing concepts for medical students. The blueprint is a valuable tool that offers

flexibility in selecting the I (impact) and F (frequency) parameters, and these choices may vary among assessors.

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Improvement of Surgical Technologist Students' Learning by Development of a Customized e-portfolio: A Mixed-method Study

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Abstract

Background: Electronic portfolios provide opportunities for students to reflect on their performance and develop their competencies.

Objectives: The present study was done to improve surgical technologist students' learning through the development of a customized e-portfolio.

Methods: This interventional study was conducted using a sequential mixed method in two phases. In the "qualitative" phase, the framework of the e-portfolio was first developed via literature review. Then, it was customized and completed through a qualitative approach of guided content analysis based on Elo & Kyngas' method. In the "quantitative" phase, by using quasi-experimental designs, the effectiveness of the e-portfolio was evaluated by measuring students' satisfaction, knowledge, and clinical skills as educational outcomes. A satisfaction questionnaire, multiple choices questionnaire (MCQ), and research-made checklist were used. Comparison of groups and data analysis was done using Fisher's exact and paired t-test. Data analysis was done using SPSS version 22 software. The maximum alpha level was considered to be 0.05 in order to confirm the difference between the groups ($p < 0.05$).

Results: In the first phase, an e-portfolio framework was developed, including discipline regulations, study resources, daily activities, educational objectives, assessment tools, feedback, and reflection reports. The paired t-test results show that students' knowledge (p -value=0.011) and clinical skills significantly improved (p -value=0.023). More than two-thirds of the students (71.42%) and tutors (85.72%) were thoroughly satisfied with the e-portfolio assessment.

Conclusion: Based on the main results, the use of applicable and standard E-portfolios is recommended as a comprehensive and cost-effective assessment method in clinical education.

Keywords: Electronic Portfolio, Clinical Education, Reflection, Surgical Technologist

Background

Today, the education of medical and paramedical students is mainly based on competency-based education (1). In competency-based education, there is an emphasis on educational consequences, professional practice, and evaluation methods. Therefore, diverse evaluation tools such as portfolios are proposed to

appraise learners' competencies and practices (2). However, the term "Portfolio" became popular in education in 1990 and was first defined as an organized complex of learned subjects (3). Over the last two decades, medical education has broadly used it to develop learners' competency (4). Portfolios are available in two formats: paper and electronic. However,

for a variety of reasons, including saving and reconsideration data related to students' practice over a certain period of time in a virtual environment, increasing motivation of students based on tutors' feedback, sharing content with tutors and other students, bolding the important data, easily updating contents, easily accessing portfolios for administrators and tutors, helping to recognize the strengths and weaknesses of students and finally reducing paper consumption, electronic or web-based portfolios are more popular (5-7). Today, the portfolio is known as a tool for gathering and assessing information relevant to learners' development in appointed assignments and defined competencies, and it is introduced as a competent method in motivating and guiding the learners towards reflection in Evaluation (2, 8). Tutors assist students in developing new knowledge and skills, correcting their malpractice, acquiring competency through effective feedback, and providing opportunities for reflection based on documents of portfolio (9, 10). Such reflection enables students to demonstrate growth and development as professionals (11). At the same time, developing the students' reflective capacity on work and learning, portfolios help to improve autonomy and collaboration with others. Also, according to the results of studies, not only can the e-portfolio become a tool to improve learning skills and competencies, but it can also contribute to improving employability and guarantee a future job (12).

According to the results of several studies such as Ekayanti et al. (2017), Belcher et al. (2014), Chae & Lee (2021), Vaghee et al. (2016), Mapundu & Musara (2019), Paulo et al. (2021), the use of electronic portfolio has had positive effects on the learning and competencies of learners in different disciplines (11-16). However, based on the researcher's literature review, the use of an e-portfolio with a certain framework has not been investigated in surgical technologists' students, especially because these students are forced to learn in critical conditions and acquire skills in the stressful climate of the operating room. On the other hand, the curriculum of this discipline in our country is different from the rest of the world. In the few examples that have been worked in Iran, it is not mentioned to reflection as a special characteristic of the portfolio. Also, as an educational outcome, it only referred to the students' satisfaction in the evaluation stage (17).

Objectives

The present study was conducted to develop a specific e-portfolio for surgical technologist students and evaluate their improvement via assessment of their satisfaction and learning.

Methods

This interventional study was conducted using a sequential mixed method in 2 phases and four stages from October 2018 to May 2020 after the approval of the initial research project in the Center for Medical Education Research and Development of the Ministry of Health and Medical Education, with license code No. 97006.

In the mixed method study, quantitative and qualitative research approaches are adapted to expand, understand, and interpret the data (18). Sequential designs are a combination of two-step research methodology, with qualitative or quantitative data collected in the first phase, and then the other data types are collected (19).

Since there was no standard framework for e-portfolios as formative assessment tools in accordance with the operating room technology curriculum in our country, the researchers decided to develop them using a qualitative method in the first phase and evaluate them using a quantitative method in the second phase, following a mixed-method study, via assessment of students' satisfaction and learning.

Phase 1: This phase was implemented in three stages. Firstly, a literature review was done in PubMed, Science Direct, Google Scholar, SID, Scopus, and Magiran databases between 1990 and 2018 with the keywords of "clinical assessment tools," "portfolio," "e-portfolio," "logbook," "surgical technologist," "operating room," and "competency." After identifying the key components and structure of a standard portfolio, including "discipline regulations," "study resources," "daily activities report," "course educational objectives," "work-based assessment tools," and "feedback and reflection reports, in the second stage, a descriptive qualitative study was conducted to determine specific component for mentioned categories according to surgical technologists' curriculum in Iran. For this purpose, based on the Elo & Kyngas method, qualitative content analysis was used with a deductive content analysis approach. In this approach, analysis processes are represented as three main phases: preparation, organizing, and reporting. Deductive content analysis is

used when the analysis structure is operationalized based on previous knowledge (20).

Participants: Fourteen Iranian expert panel members participated in this phase, including eight instructors, two board members of the operating room technology committee, three surgical technologists, and one medical educationist. The inclusion criteria for selecting participants were the experience of at least five years of educational activity, five years of activity in policy making, and clinical work experience in this field for at least ten years. Expert selection considered educational qualifications, experience in operating room fields, and willingness to participate in this process.

Data analysis: The data analysis was performed by the guided content analysis method and according to designing the basic analytical matrix in the stage of organizing in Elo & Kyngas method, including categories including “study resources,” “daily activities report,” “course educational objectives,” “work-based assessment tools,” “feedback, and reflection. Data analysis started with the first interview and continued until the fourteen interviews when the data reached saturation (20). Four criteria of credibility, dependability, conformability, and transferability of Lincoln and Guba were used to confirm the accuracy of the data (21).

For this purpose, the method of prolonged engagement with data and spending time to collect and analyze data was used to improve the credibility of the data. Also, the member check method was used in the initial coding stage to increase the dependability of the data in the interview stage. In this way, the codes and interpretations obtained from the analysis of some interviews were checked with the participants. In addition, a review by external supervisors was used to confirm the correctness of the coding. Also, to achieve the conformability criterion, the entire data collection and analysis process was described accurately and in detail, and finally, by describing the full characteristics of the participants, the transferability of the data was provided for readers to judge.

In the third stage, the e-portfolio, after consulting with the informatics engineer, converted to an electronic version, was uploaded to the website of the paramedical school at the following address: <https://tabib.abzums.ac.ir>.

Phase 2: At this phase, a quantitative study was done to establish the effectiveness of the intervention. The

extracted contents from the first phase study, uploaded to a virtual platform as the main elements of the operating room e-portfolio, were considered the main interventional plan. For this purpose, after training selective tutors and internship students, the e-portfolio was used as a formative assessment for them in the seventh academic semester.

Sampling in this phase was done in the form of a census and according to the inclusion criteria. Typical inclusion criteria for tutors included at least two years of work experience in coaching surgical technologist students and a willingness to participate in this research. Inclusion criteria for students were passing theories and practical courses and entering an internship course in the final year of education. A consent form was obtained from those who voluntarily accepted to participate in the study. Fifty-six students at the internship level and seven instructors participated in this phase.

Before using the e-portfolio, students' knowledge and practical skills were assessed as basic knowledge and practical skills. An MCQ was developed for knowledge assessment based on a blueprint of course content and consideration of the Milman checklist. Also, a checklist was developed based on instructional goals in this course to assess students' academic achievement in practice and skills. The validity of these tools was confirmed by content validity and expert panel opinions. The reliability of MCQ was confirmed by the calculation of Cronbach's alpha (0.81). For measurement of Reliability, the checklist was calculated inter-rater reliability (0.88).

From the beginning of the semester, students were required to record their training daily based on the discipline regulations, educational goals, and study resources, and they were encouraged to reflect on their daily experiences and record how they would act if they faced this situation the next time. The tutors also assessed and monitored the strengths and weaknesses of the students' performance weekly based on the assessment checklists and gave them feedback for improvement or correction. The director of the operating room group also evaluated the performance of the tutors and students at a higher supervisory level to ensure the strict implementation of the program and the feedback and opportunities for reflection given to the students. The implementation of this program continued for 16 weeks during the academic semester at the time of the study. Satisfaction, knowledge, and practical skills were evaluated after the use of the

e-portfolio again. A standard survey evaluated the satisfaction of students, and its validity and reliability were confirmed in the Ahmadi et al. (2016) study (22). In this study, Cronbach's alpha was calculated as 0.78, which is acceptable for reliability. The collected data was entered into the soJ ware SPSS 22 and analyzed using t-test and chi-square tests.

Results

Phase 1: Participants in the study's first phase were eight instructors, two board members of the operating room technology committee, three surgical technologists, and one medical educationist. The average age of participants was 41 (± 2.4), respectively. Furthermore, their experiences in the field of operating room education or working were 18 (± 3.8) years. Directed content analysis of 14 structured interviews was led to extract six main categories, including; "discipline regulations," "study resources," "daily activities report," "course educational objectives," "work-based assessment tools," and "feedback and reflection reports."

Phase 2: Based on the quantitative study results, 56 students at the internship level and seven instructors participated in this phase; sixteen students (28.5%) were male, while 40 (71.5%) were female. The mean age of the students was 20.01(± 1.74). The instructors were all female, with a mean age of 33.96 (± 1.37). The results of the quantitative phase of the study, students' and instructors' satisfaction levels, and improvement of students' knowledge and skill scores in Tables 1 and 2 are shown.

Based on Fisher's exact and numerical analysis results, there was no significant difference between the satisfaction levels of students and instructors and their demographic traits, with a p-value of 0.518.

Results demonstrated that more than two-thirds of the instructors and the students were completely satisfied with the e-portfolio assessment. In an analysis of the survey's open-ended question (would you please explain the advantages and disadvantages of this method of assessment in comparison to other commonly used

methods?), instances like resource management, the need for internet infrastructure, access to information, improvement of interactions, organized assessment, learning by assessment, transparency of assessment, informative assessment, and finally opportunities for reflections and independent learning were identified.

The paired sample t-test results showed that the students' knowledge and practical skills significantly improved after using the e-portfolio.

Discussion

The findings of the qualitative phase of this study led to the extraction of six main categories for developing an authentic e-portfolio framework, including discipline regulations, study resources, daily activities, educational objectives, assessment tools, feedback, and reflection reports. Numerous studies, such as Ekayanti et al. (2017), Belcher et al. (2014), Chae & Lee (2021), and Tan & Ting (2022), confirmed these requirements and documents in making the framework of e-portfolios (13-15, 23).

In the quantitative phase of this study, the results show that most of the students and instructors were satisfied with the e-portfolio for clinical competency assessment. Asadi et al. (2014) preferred this method of assessment over other commonly used methods (24). In other similar studies, students were more satisfied with the portfolio method than the other commonly used methods because this method focuses on students' progress and feedback from preceptors (25). According to Ahamdi et al. (2016), the total score of satisfaction with the e-portfolio assessment was higher than the other common assessments (22). Contrary to these results, Tailor et al. (2014) believed that 60% of medical interns did not benefit from e-portfolios (7). In another study, students reported low motivation and moderate self-confidence when it came to using e-portfolios (26). Different results can be due to initial anxiety in applying this method, incompleteness of the prepared system content, unfamiliarity with the system, and lack of sufficient supervision and unstructured assessment. Van der et al. (2020) studied 90 e-portfolios.

Table 1. Frequency of students and instructors' satisfactions with e-portfolio

Variable	Frequency (%)			X ²	df	P-value
	Completely satisfied	Relatively satisfied	Unsatisfied			
Students' satisfaction	40 (71.42%)	14 (25%)	2 (3.58%)	0.64	2	0.518
Instructors' satisfaction	6 (85.72%)	1 (14.28%)	0 (0)			

df: Degree of freedom

Table 2. Comparison of the students' knowledge and practical skill scores before and after using an e-portfolio

Assessment parameter	Before	After	Mean difference	t	P-value
	Mean (SD)	Mean (SD)			
Knowledge	4.29 (1.58)	7.89 (1.63)	3.6	1.54	0.011
Practical skill	5.89 (1.34)	8.83 (1.01)	2.94	1.05	0.023

SD: Standard deviation

They indicated that the feedback received was mostly limited to general opinions and lacked specific comments and recommendations for further action. Also, no specific goals were defined for learners (27). Thus, the items considered, the preparedness of preceptors and learners, and the motivation for this tool's constant and correct use all impact its efficiency and students' satisfaction. Yoo et al. (2020) believed that the results are more valid when evaluators with an appropriate education do the assessments based on certain standards and systematically (8). In many cases, the students emphasized structured, informative assessment in their learning path. Tan & Ting (2022) confirmed that one of the important uses of the portfolio is informative assessment (23), as the last subject that students mentioned in the open-ended question was the importance of feedback and reflection. They believed that this assessment tool gave them an opportunity to think and improve their learning. Developing reflective skills is one of the unique features of portfolios that lead to improving clinical skills (28). Sánchez et al.'s (2013) study showed that e-portfolios guided students' learning process by indicating knowledge gaps to themselves and teachers (29). Annemarieke et al. (2015) found that the e-portfolio approach is helpful for professional development, setting educational goals, assessing competency, and receiving support from supervisors (30). Other studies recommend that using portfolios and e-portfolios with feedback could help students with academic achievement (29, 31-33).

Also, the results of a study in the assessment aspect indicate that e-portfolios have a positive impact on the improvement of students' learning in cognitive and psychomotor domains. As a result, Lai & Wu (2016) claimed that portfolios aided clinical learning through features such as self-awareness, self-assessment, and self-judgment (34). Furthermore, Vaghee et al. (2016) reported that e-portfolios improved students' academic achievement by involving students in teaching-learning (16). Mapundu & Musara (2019) demonstrated that e-portfolios increase learning due to features such as flexibility and students' participation in learning (12). In other studies, portfolios enhanced learning during training in a women's ward (35) and enhanced both the

quality and the depth of learning in medical students (25). Sánchez et al. (2013) investigated e-portfolios to assess surgical skills quantitatively. Seventy-nine percent of the students felt they had more access to their professors, and at the end of each course, on average, students reached 65% of the defined general goals and 87% of the skill goals (29). In another similar study, this tool increased the clinical competency of nurses in all aspects (36). All of the preceding studies are consistent with this study's results. Therefore, this method seems to improve clinical skills by increasing interaction between the student and the preceptor, increasing feedback, and encouraging students to reconsider.

Paying attention to all the components of a standard structured portfolio was one of the strengths of this study, which can be used as a model in other disciplines. Also, the evaluation of the effectiveness of this assessment tool in the variables of satisfaction and learning is another positive highlight of the present study, but since this study was done in a quantitative stage in a semi-experimental design before and after in one group, it can be conducted in future studies between two groups of cases and control groups or to examine the effectiveness of it in related to other variables such as critical thinking, academic enthusiasm, etc.

Conclusion

Regarding the positive impacts of this method of assessment on students' satisfaction, knowledge, and skills, it seems that applying an e-portfolio as one of the novel assessment tools can be a proper replacement for the present assessment methods by providing opportunities for feedback and reflection. Therefore, this method is recommended in the clinical assessment of surgical technologist students.

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Conflict of interests: There is no conflict of interest.

Ethical approval: This project has been accepted by the ethical committee of the National Center for Strategic Research in Medical Education in Iran; ethical code: 97006.

Researchers obtained verbal informed consent from all participants after giving similar educational information about the study's objectives to the participants in the training meetings. Also, obtaining verbal consent from the participants was mentioned in the initial proposal of this research, and the ethics committee was aware of this.

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Factors Affecting Clinical Education Standards in Nursing in Iran: A Systematic Review

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Abstract

Background: Clinical education has long been known as one of the influential ways to improve the quality of nursing services.

Objectives: The present research was conducted aiming to determine the factors affecting clinical education standards in nursing in Iran.

Methods: This study was a systematic review in which published articles related to the factors affecting clinical education standards in nursing in Iran were searched. Based on the research inclusion criteria, 30 articles were selected and the data were analyzed using the content analysis method.

Results: The most important factors affecting clinical education standards in nursing in Iran were categorized into three areas: educational goals and planning, educational structure, and educational process. The most important affecting factors included “the presence of a codified educational program for clinical education and interactions”.

Conclusion: The most crucial actions that can be taken to help improve nursing clinical education and elevate its standards include preparing a codified educational program for clinical education, trying to improve interactions in the clinical education environment, and improving instructors’ performance and skills to train nursing students.

Keywords: Clinical Education, Standards, Nursing

Background

Clinical education is an integral part of the nursing curriculum in which students synthesize the profession’s knowledge, skills, attitudes, values, and philosophies, accounting for about 50% of the nursing curriculum time (1, 2). Clinical education aims to acquire professional skills and set appropriate stage for use at the time of clinical care. At this stage, students experience the clinical setting by learning clinical activities and are guided toward the relationship between theory and practice to solve complex healthcare problems and provide safe care with critical thinking (3). On the other hand, nursing schools are supposed to train nurses who are able to provide clinical services based on the latest scientific advancements and can satisfy the patients’ needs with sufficient knowledge and clinical skills (4). Weak planning in this regard will create problems, leading to weak professional skills and decreased efficiency of graduates (5). The nurturing of competent nurses without appropriate clinical

education is a far-reaching goal, and the presence of any problem in clinical education compromises its efficiency and effectiveness (4). The results of Torabizadeh et al.’s study indicated a direct and significant correlation between the use of educational behaviors by clinical instructors and the effect of these behaviors on nursing students’ learning. In terms of the amount of applying educational behaviors, the areas of teaching ability and personality traits, and in terms of effectiveness and learning, the areas of teaching ability and evaluation achieved the highest and lowest priority, respectively (6). In Shoja et al.’s study, the challenges of clinical education were determined in six main areas: Instructors’ insufficient mastery of clinical departments, students’ insufficient preparation to enter internship, lack of support from staff for students, lack of a codified educational program for clinical education, lack of a specific model for clinical assessment, and lack of patient cooperation and trust toward the students (7). In the meantime, it seems that there are still some issues

inhibiting students from effective learning because they cannot practically implement what they have learned. Even students who are theoretically well knowledgeable, most of the time face problems at the patient's bedside and are not able to provide care and perform skills independently. Neglecting clinical education will lead nursing students to not perform proficiently in the clinical setting despite having sufficient theoretical knowledge, and by entering the treatment and healthcare system, the quality of service provision will lessen over time. Clinical internships are extremely important in the formation of professional identity and are indeed called the heart of nursing professional education. Nursing clinical education is an integral part of theoretical education and both complement each other. Clinical education is simultaneously different and very complex. The existence of standards for clinical education management and also the evaluation of factors affecting these standards will help narrow the gap between theoretical and clinical education and the nursing students' process of achieving competence and will culminate in nurturing proficient nurses in patient care (8).

Overall, clinical education standards are related to five areas, including clinical instructors, students, educational programs, resources and facilities, and teaching-learning activities (9), which are assessed by internal and external evaluation programs in nursing faculties. However, it should be stated that clinical nursing education in clinical education centers in Iran is not at present at the acceptable level of these standards and is encountering many challenges. Therefore, conducting any research in this field can be a window to the realities or solutions to solve available problems in the future (10).

Objectives

According to the cases mentioned above and the importance of the topic, the current research was conducted aiming to determine the factors affecting clinical education standards in nursing in Iran.

Methods

This study was a systematic review conducted based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (11). In line with the research objective, the ProQuest, Magiran, Scientific Information Database (SID), ScienceDirect, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, and PubMed

databases were searched and Persian and English articles conducted during the last 15 years (2007-2022) on nursing clinical education and factors affecting its standards in Iran were reviewed. The reason for selecting this period of time for studies was that the researchers sought to collect up-to-date and new information about the factors affecting the standards of clinical nursing education and to investigate a broad spectrum of information, factors, communications, and changes related to the topic. Moreover, the selection of articles from different periods of time can enhance the variety of information in review articles, contributing to a more extensive analysis and a more comprehensive evaluation of the topic. For searching related articles in the databases, appropriate keywords were initially selected from medical subject headings (MeSH), and then a search was performed using the keywords "Clinical nursing education, Nursing student, Clinical nursing education factors, Clinical nursing education problems, Clinical nursing education challenges, and Clinical nursing education standards" in Persian and English using the two operators AND and OR for 20 days from the 21st January to the 9th February 2023.

Based on the Patient, Intervention, Comparison, Outcome (PICO) criteria, the inclusion criteria for the present study include Persian or English language, type of article (descriptive, qualitative, review, and descriptive-analytical), access to the full text, the population under investigation (nursing instructors, nursing students, and nurses), the research subject (direct relationship with clinical education), the place of conducting research (Iran), and the article publication time (2007 to 2022). The exclusion criteria included the article language other than English or Persian, the article type (other than descriptive, qualitative, review, and descriptive-analytical), such as interventional articles, meetings, and letters to the editor, lack of access to the articles' texts, absence of nursing students or graduates in the investigated samples, the lack of relationship between the research topic and the current research's objectives (factors affecting clinical education standards in nursing), such as studies on theoretical education in nursing, conducting research in other countries, and articles published outside the intended time period (2007 to 2022). All searched articles were reviewed by two researchers and any disagreements were reconciled via discussion between them and according to the research objectives.

The article selection process was performed based on the following protocol:

- Searching articles (titles with or without abstract)
- Assessing the relationship between the article's abstract and the study objectives
- Assessing the article's full text and its relationship with the study objectives
- Performing main screening (in terms of the sample size, the study year, the related field of study, the field under investigation, the quality and methodology of the studies obtained by two researchers)

Detailed evaluations were carried out by two researchers independently based on the checklists related to the methodology of each research [the Strengthening the Reporting of Observational Studies in Epidemiology (STORBE) statement for descriptive studies, Consolidated Criteria for Reporting Qualitative research (COREQ) statement for qualitative research, and the PRISMA statement for review studies] and studies that gained less than 80% of the scores of these checklists were excluded from the study. After reviewing the articles, 30 articles were finally entered into the research (Figure 1). The intended data were then extracted from the qualified articles and recorded in Excel software. The data extracted from the articles encompassed the following sections: The authors' names, the study year, the study language, the study type, the study title, the sample size, and the summary of results.

In the current research, the data were analyzed using the content analysis method. Two researchers extracted and classified the results of the articles independently, and the data accuracy was assessed by the process double check by another researcher in the research team. Then,

the data collected from the articles were organized in the relevant tables.

Results

The results obtained from various studies on the factors affecting clinical education in nursing in Iran, which also influence clinical education standards in nursing, are summarized in Table 1. It is worth mentioning that the articles used in the present research consisting of 14 English and 16 Persian articles have been arranged according to the publication year and provided in Table 1.

In the present research, the factors affecting clinical education standards in nursing were classified into several primary and secondary areas and based on priority. The three primary areas include educational goals and planning, educational process, and educational structure, each of which has its own secondary areas prioritized in Table 2 according to their repetition and importance in previous studies. In the educational goals and planning area, 9 factors affecting clinical nursing education had been mentioned in the investigated studies, the most important of which include the presence of a codified educational program for clinical education (13 articles), the presence of a specific model for monitoring and evaluation (9 articles), and the university and hospital clinical education coordination (the short practical period before entering the hospital, the longtime interval between the practical period and entering the hospital setting) (9 articles).

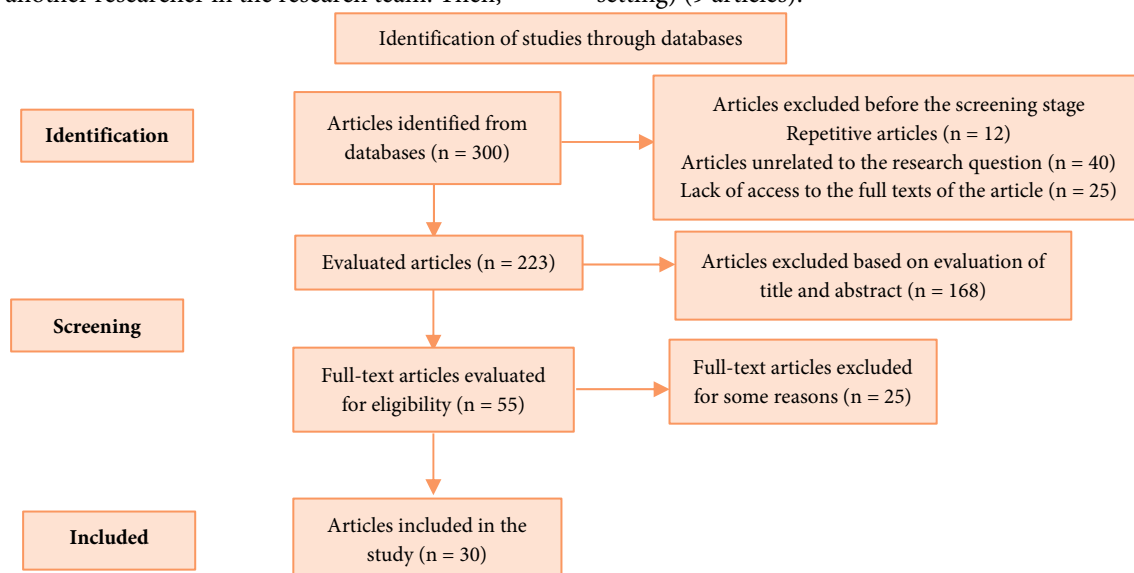


Figure 1. The article selection process based on the Preferred Reporting Items for Systematic Reviews and Meta-Analysis checklist

Table 1. Studies on the factors affecting clinical education standards in nursing in Iran

Sources	Language	Study Type	Title	Sample Size	Summary of the Results
Ghodsbin & Shafakhah (12)	Persian	Descriptive	Facilitating and preventing factors in learning clinical skills from the viewpoints of the third-year students of nursing at Fatemeh School of Nursing and Midwifery	54 nursing students	Facilitating factors: Instructors' experiences, providing an appropriate environment by instructors Preventing factors: Stress in the ward, inappropriate atmosphere of the ward, lack of support for students by staff, and hot-tempered and angry staff
Yazdankhah Fard et al. (13)	Persian	Descriptive	The stressful factors in clinical education: the viewpoints of students at Bushehr University of Medical Sciences	334 students in the fields of nursing, midwifery, medicine, and paramedicine	Stressful domains: Humiliating experiences, educational setting, clinical experiences, unpleasant feelings, interpersonal relationship Stressors: Instructor's warning in the presence of staff and doctors, lack of welfare facilities, witnessing critically ill patients' suffering, concern about the transmission of contagious illnesses, instructor's lack of support
Borzapardenjani et al. (14)	Persian	Descriptive	The clinical education status from the perspectives of students at the School of Nursing and Midwifery, Tehran University of Medical Sciences	250 nursing and midwifery students	Strengths: Timely attendance of students and instructors, compliance with courses' prerequisite credits, instructor's good behavior, interested instructors, experienced instructors. Weaknesses: Insufficient facilities, not using educational aids, inappropriate number of students in the ward, inappropriate number of patients for learning cases, disregarding students' opinions in planning, student's inability to make decisions for patient care planning, non-coordination of the ward personnel expectations and educational goals, having no weekly clinical conference
Toulabi et al. (15)	Persian	Descriptive	The appropriateness of educational programs' objectives for professional needs: The viewpoints of Khorramabad School of Nursing and Midwifery graduates	407 nursing and midwifery graduates	The most common elements affecting the quality of educational programs: Experienced instructors, educational facilities, appropriate atmosphere, teaching methods, the faculty's educational facilities, available scientific resources, diagnostic, clinical, and therapeutic facilities, paying attention to students' opinions, the faculty's appropriate atmosphere, rules and regulations
Abotalebi et al. (5)	Persian	Descriptive	Evaluation of clinical education from the viewpoints of nursing students of Ardabil University of Medical Sciences in 2009	90 nursing students	Strengths of clinical education: Timely attendance of students, timely attendance of instructors, presentation of course objectives, availability of instructors, student's information about the way of evaluation, instructors' appropriate behavior Weaknesses: Insufficient welfare facilities, lack of educational aids, non-coordination between educational goals and staff expectations in the wards, non-cooperation of theoretical courses and internships, instructors' inability to relieve students' stress
Pakpour et al. (16)	Persian	Descriptive	Nursing students' understanding of the current status of the clinical education environment at Tehran University of Medical Sciences	217 nursing students	The area of personifying the student in the clinical setting and using educational innovations in students' clinical education had the highest and lowest scores, respectively. Students regarded human relations in the clinical education setting as one of the most important priorities in clinical internships.
Mogharrab et al. (17)	Persian	Descriptive-analytical	Factors affecting clinical education from the viewpoints of clinical nursing students and instructors (2010-2011)	120 nursing students and 28 nursing instructors	Most of the students and instructors evaluated the status of equipment, specialized facilities of the clinical setting, and welfare affairs as excellent. Eighty percent of the students evaluated the performance of the nursing staff as undesirable and 85% of the instructors evaluated it as excellent.

Table 1. Studies on the factors affecting clinical education standards in nursing in Iran (continue)

Sources	Language	Study Type	Title	Sample Size	Summary of the Results
Heidari et al. (18)	Persian	Descriptive-analytical	Problems of clinical education of nursing students in clinical settings	75 nursing students	<p>The most common problems of clinical education:</p> <p>The instructor-related area: Lack of support from the instructors for the students</p> <p>The clinical education learners-related area: Unclear description of the student's duties and expectations</p> <p>The clinical setting-related area: Lack of welfare facilities and education in the clinical wards</p> <p>The educational program-related area: Lack of a codified educational program for clinical education</p> <p>The clinical assessment-related area: Lack of a specific model for clinical assessment</p> <p>The patient-related area: Patient non-cooperation and trust in students</p>
Rasouli et al. (19)	Persian	Descriptive	Investigating the expectations of Urmia nursing and midwifery students from the instructor and perceived stressors during clinical and theoretical education in 2013	210 nursing and midwifery students	<p>Expectations: Demonstrating understanding and empathy by instructors and establishing good relationships with students</p> <p>Stressors: Instructors' harsh warnings during the course, lack of self-confidence regarding implementing care processes, bad behaviors of nurses, doctors, and patients</p>
Rafiee et al. (20)	English	Qualitative	Problems and challenges of nursing students' clinical evaluation: A qualitative study	40 nursing students and 8 instructors	Main themes: Inappropriate method of clinical evaluation, problems of clinical evaluation process, problems related to clinical instructors, inappropriate planning of clinical education, organizational shortcomings
Kermansaravi et al. (21)	English	Qualitative	Nursing students' views of nursing education quality: A qualitative study	40 nursing students	Three main themes: Theoretical education (teaching method, educational content, instructor's characteristics), clinical education (impairments in educational planning and educational environment, and instructor's characteristics), the gap between theoretical education and clinical education (the application of theory in practice, compliance with scientific principles in practice)
Heidari & Norouz Zadeh (22)	English	Qualitative	Nursing students' perspectives on clinical education	150 nursing students	<p>Study results regarding clinical education</p> <p>Educational goals and programs: The highest score was related to the clinical instructor and the lowest score was related to the clinical setting.</p> <p>The goals of clinical education area: The highest score was related to the presentation of students' description of duties and also the goals of clinical education on the first day of education, and the lowest score was related to the coordination between educational goals and staff expectations from students.</p> <p>The clinical instructor area: 53.79% of responses were positive, indicating more agree perspectives regarding clinical instructors and 18.5% had negative perspectives.</p> <p>The interaction with student area: The highest score was related to strengthening students' self-confidence by the instructor and staff, and the lowest score was related to empowering students to make decisions in patient care planning.</p>
Baraz et al. (23)	English	Qualitative	Learning challenges of nursing students in clinical environments: A qualitative study in Iran	18 nursing students	Challenges of clinical learning: Nursing instructors' inadequate competence, non-supportive educational setting, stressful psychosocial environment, traditionalism in clinical performance, no access to direct experience of nursing techniques

Table 1. Studies on the factors affecting clinical education standards in nursing in Iran (continue)

Sources	Language	Study Type	Title	Sample Size	Summary of the Results
Bigdeli et al. (24)	English	Descriptive	Clinical learning environments (actual and expected): Perceptions of Iran University of Medical Sciences nursing students	127 nursing students	The highest mean score difference in actual and preferred form was in innovation and the lowest was in the participation scale
Farzi et al. (25)	Persian	Qualitative	Exploring the challenges facing nursing procedures education from the perspectives of nursing students: A qualitative study	12 nursing students	The 5 main categories included the transition from practice to the clinic, discrepancy between education and performance, fears, the clinical instructor's performance, and inclusive features.
Sharafi et al. (26)	English	Descriptive-analytical	Evaluation of coordinating theoretical education with clinical training in nursing students from the perspective of teachers of Mashhad School of Nursing and Midwifery	90 instructors	The sufficiency of educational facilities in the educational hospitals of Mashhad University was less than average; 93% of nursing educators believed that communication with hospital staff greatly affects their cooperation. The lowest consistency between skills and the duration of clinical education courses was observed in special and emergency wards.
Pakpour et al. (27)	Persian	Descriptive	Nursing students' satisfaction with the clinical education environment at Iran University of Medical Sciences	127 nursing students	The highest mean score in the evaluation of the current status of the clinical education setting belonged to the area of personifying students in the clinical setting and the lowest belonged to the area of using educational innovations in clinical education.
Rezaei (28)	English	Descriptive-analytical	The clinical education quality (a case study from the perspectives of nursing and midwifery students at Islamic Azad University, Falavarjan Branch)	361 nursing and midwifery students	The quality of education in the areas of behaving the students, monitoring and evaluation, educational goals and programs, and instructors' performance at a moderate level. The educational setting area was at a poor level. By increasing the academic semester, the total scores of the scale, and the five areas of the clinical education scale decreased from the students' viewpoints; 33% of students were not satisfied with the assessment method in the internship; 58% of students believed that the number of students is not proportional to the physical space of educational departments; 77% of students believed that medical staff have no favorable cooperation with them during clinical education.
Jamshidi et al. (3)	English	Qualitative	The challenges of nursing students in the clinical learning environment: A qualitative study	17 nursing students and 3 instructors	Three main categories: Inefficient communication, insufficient preparation, emotional reactions
Vali et al. (29)	English	Descriptive	Nursing students' perspectives on effective educational strategies of clinical instructors: A descriptive study	150 nursing and midwifery students	The most effective strategies: Respectful behavior with students, clients, and colleagues, enthusiasm to guide students and manage their problems
Aghaei et al. (30)	Persian	Descriptive	The perspectives of nursing students on the elements affecting bedside education	150 nursing students	The students of all the six investigated faculties in Tehran evaluated the educational goals and programs carefully. Students evaluated the instructor's field as average. The weakness existed in the areas of behaving students, clinical setting, and monitoring and evaluation.
Torabizadeh et al. (6)	Persian	Descriptive-correlational	The relationship between the instructors' clinical education behaviors and the nursing students' learning at Shiraz University of Medical Sciences	128 nursing students	The teaching ability area had the highest and the assessment area had the lowest priority on effectiveness and clinical learning. Teaching ability was mostly influenced by clinical instructors' personality traits and teaching skills (6).

Table 1. Studies on the factors affecting clinical education standards in nursing in Iran (continue)

Sources	Language	Study Type	Title	Sample Size	Summary of the Results
Bazr Afkan & Najafi Kalyani (31)	English	Qualitative	Nursing students' experiences of clinical education: A qualitative study	16 nursing students	From this study, five categories emerged, including disrupted theory and practice, unstable communication, insufficient planning, and personal and professional growth.
Farzi et al. (1)	English	Qualitative	Exploring the challenges of clinical education in nursing and strategies to improve it: A qualitative study	35 nursing students and 5 instructors	Two main categories: Challenges of clinical education in nursing and strategies to improve clinical education in nursing
Jasemi et al. (32)	English	Qualitative	Challenges in the clinical education of the nursing profession in Iran: A qualitative study	9 nursing students, 3 clinical nurses, and 2 instructors	Two main issues: Inefficient educational structure and inefficient professional performance environment
Najafi Kalyani et al. (33)	English	Qualitative	How do nursing students experience the clinical learning environment and respond to their experiences?: A qualitative study	19 nursing students, 4 instructors, and 3 clinical nurses	Problems experienced in the clinical education setting: Inefficient educational context, inefficient instructors, instructors' inability to provide effective education, unfavorable educational planning, incompatibility of educational programs with students' needs and expectations, inappropriate clinical setting
Khedmati Zare et al. (34)	Persian	Descriptive	The clinical education status and factors affecting effective clinical education from the perspectives of undergraduate nursing students at Alborz University of Medical Sciences	155 nursing students	The most effective factors: Inclusive personal traits, clinical instructor's personal traits, clinical setting conditions, educational programming, and clinical assessment
Mortazavi et al. (35)	Persian	Descriptive	Factors affecting the quality of clinical education from the perspective of teachers and learners of Saveh hospitals	198 nursing and paramedical students	The most important effective factors: Improvement of educational processes, results and consequences of improving the educational process, lack of proficient human force, lack of space and facilities and equipment, correct educational evaluation
Rezakhani Moghadam et al. (36)	English	Qualitative	Challenges faced by nursing students to work with nursing personnel: A qualitative study	20 nursing students	Learning challenges: Inappropriate social norms, inappropriate organizational climate, insufficient resources
Shoja et al. (7)	Persian	Review	Challenges of clinical education for Iranian undergraduate nursing students in Iran: A review study	23 articles	Challenges of clinical education: Instructors' inadequate mastery of clinical wards, student's insufficient preparation to enter internship, lack of support from staff for students, lack of a codified educational program for clinical education, lack of a specific model for clinical assessment, patient non-cooperation and trust in students

Table 2. The most important factors affecting clinical education standards in nursing in Iran

Educational Goals and Planning	Educational Structure	Educational Process
<p>The presence of a codified educational program for clinical education</p> <p>The presence of a specific model for monitoring and evaluation</p> <p>The university and hospital clinical education coordination (acquiring required clinical skills in the practical period, the short practical period before entering the hospital, the longtime interval between the practical period and entering the hospital setting)</p> <p>Proportionate number of theoretical and practical credits</p> <p>The presence of a gap between theoretical courses and clinical practice in nursing</p> <p>Presenting course objectives and the way of evaluation to students</p> <p>Paying attention to the students' opinions regarding the educational program</p> <p>Using educational innovations</p> <p>Improving the quality of education</p>	<p>Interactions (the relationship between instructor and student, the relationships of student and instructor with hospital staff)</p> <p>Educational environment and facilities</p> <p>Students' personal traits (fears, attitude, self-confidence, etc.)</p> <p>Applying skilled and experienced instructors</p> <p>Environmental stressors (aggressiveness of the medical staff, patient lack of trust and cooperation with students, presence of companions at the patient's bedside)</p> <p>Commitment and motivation of instructors and students</p> <p>Adequate number of nursing staff and sufficient commitment</p> <p>Proportionate number of students and the clinical setting</p> <p>Students' academic years</p> <p>The existence of rules and regulations in clinical education</p>	<p>Instructor's mastery of educational content and appropriate clinical performance</p> <p>Instructor's respectful behavior with the students</p> <p>Staff cooperation with students</p> <p>Empowering and engaging students in clinical activities</p> <p>Instructor's support for students in the clinical setting</p> <p>Clear description of students' duties</p> <p>Punctuality and timely attendance of instructors and students</p> <p>Instructor's availability</p> <p>Patient collaboration with students</p> <p>Holding clinical conferences</p> <p>Using appropriate teaching methods</p> <p>Attention to patients' rights and needs</p>

In the educational structure area, 10 items were mentioned, the most important of which are interactions (the relationship between instructor and student, the relationships of student and instructor with hospital staff) (14 articles), educational environment and facilities (13 articles), and students' personal traits (attitude, fear, and self-confidence) (10 articles). Furthermore, the educational process area included 12 related factors affecting clinical education in nursing, the most important of which are the instructor's mastery of educational content and appropriate clinical practice (9 articles) and the instructor's respectful behavior toward students (9 articles).

Discussion

The present systematic review was conducted aiming to determine the factors affecting clinical education standards in nursing in Iran, and the factors affecting clinical education standards in nursing were divided into three general areas: Educational goals and planning, educational structure, and educational process. The most important cases in the educational goals and planning area were the presence of a codified educational program for clinical education, the presence of a specific model for monitoring and evaluation, and university and hospital clinical education coordination. In the educational structure area, the most important affecting factors included interactions (the relationship between instructor and student, the relationships of

student and instructor with hospital staff) and educational environment and facilities. In the educational process area, the instructors' mastery of the educational content and appropriate clinical practice and the instructor's respectful behavior toward students are among the most essential factors affecting clinical education standards in nursing.

In the current research, the most crucial factor in the educational goals and planning area was related to the presence of a codified educational program for clinical education. Educational planning programs and methods affect the clinical education manner and depth and the staff under training and help the clinical education development and progress process (37). In Delaram's study, educational goals and programs were also among the most crucial strengths of clinical education (38). Since clinical education is practice-based, it requires precise and coherent educational planning to provide students with the opportunity to develop clinical skills. Hence, clinical education will fail without precise and correct planning (37).

The presence of a specific model for monitoring and evaluation was another important affecting factor in the educational goals and planning area. Some of the clinical evaluation challenges include the non-uniformity of the assessment process, not applying modern assessment systems, impairments in objective assessment, and instability of the used tools (39). Conducting an assessment impacts motivation and it can particularly

affect the learners' willingness to accept responsibility for learning, independent progress, and display constant motivation in learning (40). Thus, assessment is the main factor in achieving the final goal that an individual seeks by performing a task (41).

Coordination between university clinical education and hospital clinical education is also one of the significant factors affecting clinical education standards in nursing in Iran. One of the chief missions of the nursing faculty is nurturing proficient and efficient human resources. Before entering the real clinical setting, nursing students must have received the required and sufficient education in the faculty and have been assessed appropriately (25). Previous studies also regarded the appropriateness of the educational setting regarding required facilities and equipment, enough time and opportunity to repeat clinical skills, and the presence of a rational time interval between learning the clinical skills in the practical and clinical setting as essential for effective clinical education (25, 42, 43).

Other important factors affecting clinical education standards in nursing in Iran include the relationship between instructor and student and also the relationships of student and instructor with hospital staff. In Jahanpour et al.'s research, the instructors' interpersonal relationships were also mentioned as a chief theme affecting clinical education (44). Furthermore, in Moridi and Khaledi's study, the most important factor facilitating learning clinical skills among students in the field internship was the relationship between instructor and student (45). In this regard, it can be stated that benefitting from capable instructors with high communication skills is helpful in order to enhance students' motivation and interest in clinical education and resolve existing challenges (32). Training communication skills to students with an emphasis on the difference between the classroom and the clinical setting can also be very beneficial (7).

Another affecting factor is the importance of the clinical education environment and facilities, which has been mentioned in numerous studies. Some studies report students' dissatisfaction with educational facilities. One of the most important clinical education problems reported in the studies conducted by Aboutalebi et al. (5) and Rezakhani Moghadam et al. (36) is the shortage of welfare and educational facilities for students. The presence of appropriate space and required facilities to implement care procedures, as well as physical and environmental security, is one of the significant and influential prerequisites in clinical

education, which should be provided by educational institutions based on the existing standards. The conducted studies also indicate that special attention should be paid to equipment and facilities (46).

In the present research, the most important factors affecting clinical education standards in nursing in the educational process area are related to the educational instructors' traits. A nursing instructor is the most important factor and role model in learning and can play a vital role in training students by recognizing his/her profession carefully, leading to fostering students' self-confidence and self-esteem (47). Improving the performance of clinical instructors requires equalizing the teaching principles with the learning principles. It is worth mentioning that since students are always dissatisfied with the low quality of the teaching process, emphasis must be placed on the importance of education, high quality of new instructors' performance, instructors' continuous professional growth, careful evaluation of instructors' teaching, and the adoption of managers who change management strategies effectively (48). In addition, the instructors' inappropriate behavior can lead to reducing students' self-confidence and motivation (49). Given the cases mentioned above, educational planners need to pay attention to the clinical instructors' educational role, increasing the number of consultants to monitor the activities of instructors and students, and also enhancing instructors' motivation to provide more effective clinical education in order to promote the quality of clinical education.

Limitations: One of the limitations of the current study was that the factors affecting clinical education standards in nursing were examined only from the perspectives of nursing students and clinical instructors. Moreover, due to the lack of access to the full texts of some articles, some factors affecting clinical education standards in nursing may not have been evaluated in this research.

Conclusion

According to the results of the present research, it can be stated that the key actions to help improve nursing clinical education and its standards encompass preparing a codified educational program for clinical education and improving instructors' performance and skills for training nursing students. Also, the presence of a specific model for monitoring and evaluating students and the use of a modern assessment system by instructors can have considerable effects on improving nursing students' learning. Furthermore, trying to find

strategies to elevate cooperation and improve interactions between nursing staff and nursing students and providing an appropriate learning environment can culminate in increasing nursing students' motivation and improving clinical education standards in nursing.

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

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Revolutionizing Medical Education via Electronic Question Banks

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Abstract

Assessments in medical education play an indispensable role in the making of competent medical graduates, who are knowledgeable and skilled enough to meet the changing needs of the healthcare practice. For the assessment of the cognitive domain in medical education, paper-based assessments have been used for generations together, but these assessments have their own set of limitations, and we must look for alternative options to overcome these limitations. Electronic question banks (EQBs) have been linked with multiple benefits for medical students, beginning with easy accessibility, that too at their times of convenience. The process of initiating an EQB in a medical college has its challenges and we must adopt a comprehensive approach to overcome these challenges. In conclusion, electronic question banks can ensure that medical education is delivered in an innovative manner, which in turn becomes crucial in developing competent healthcare professionals. The need of the hour is to overcome the hurdles that can impact the implementation of EQBs, and thereby augment the benefits to medical students.

Keywords: Electronic Question Banks, Technology, Medical Education

Background

Assessments in medical education play an indispensable role in fostering competent medical graduates, who are knowledgeable and skilled enough to meet the changing needs of the healthcare practice (1). In fact, based on the performance of medical students in assessments, teachers gain in-depth insights about how much students have learned, how they have learned, in which topics students have performed better, and what areas need more attention to help students attain the intended learning objectives (2). Paper-based assessments have been used for generations to assess students' cognitive performance in different subject areas taught to them during their training in medical schools, but these types of assessment have their own set of limitations, such as limited scope for interaction, being time-consuming, subjective scoring, questions' lack of modifiability once printed, paper wastage, concerns pertaining to storage and archiving of papers, and security concerns (1-3).

This calls for alternative options to overcome these limitations (1-3). The purpose of the current article was to

explore the scope and merits of electronic question banks, identify their potential challenges in the implementation phase, and offer strategies to overcome them.

Electronic Question Banks: Benefits for Students

Electronic question banks (EQBs) offer multiple benefits for medical students, beginning with easy accessibility at convenient times (4). This means that the learning process does not remain restricted to within the four walls of lecture halls, rather students can take their individual calls and decide when to learn and how to learn (supporting the principle of adult learning). Further, EQBs ensure that students are exposed to a wide range and types of questions of varying difficulty levels, which in turn can fulfill the needs of students with different learning styles, promoting inclusivity (5, 6). As students can have access to EQBs at any time, this becomes a source for the continuous reinforcement and gradual improvement of their knowledge on the subject (7).

Depending on their performance in these assessments, students become motivated to practice self-directed learning, which happens to be a crucial attribute of medical graduates (7).

Because EQBs are conducted using electronic platforms, students are acquainted with digital platforms often used in national entrance exams or certification assessments (4). This would eventually reduce students' anxiety, which is often attributed to high-stakes assessments (6). At the same time, students even become well-primed and learn the art of managing their time and approach during exams. Moreover, EQBs can be regularly updated, ensuring that students remain in touch with recent developments (8). Further, we can develop a mechanism to provide immediate feedback to

students about their performance, helping them strengthen their positives and repair their shortcomings (9). Finally, EQBs help students gradually boost their technological literacy and remain at par with their counterparts across the world (5, 6).

Challenges of EQBs and Potential Solutions (Table1)

Establishing an EQB in a medical college faces some challenges requiring a comprehensive approach to be addressed (2). These challenges can be technological, wherein users may lack access to appropriate technology devices or technical assistance precluding them from using EQBs (4).

Table 1. Challenges and Potential Solutions of Developing EQBs

Challenges	Potential solutions
Resistance to change	Elucidating to both faculty members and students the scope and merits of EQBs
	Sharing successful experiences of other institutions and how they have transformed the learning process by the implementation of EQBs
	Creating an open platform, where people can raise their queries-cum-clarifications
Content maintenance	From each department, 1-2 persons should be designated to manage and regularly update the content of EQBs
	Formulating a schedule and communicating it to all experts in advance to review the content periodically
Preference for only specific types of questions	Involving teachers in the process of developing EQBs
	Reaching consensus at the institutional level with regard to the type of questions, difficulty levels, etc., and accordingly instructing departments to set limits on the frequency of specific types of questions
	Regularly communicating with educators to ascertain the difficulty level and make suitable modifications
Lack of quality assurance	Establishing a robust peer-review process, wherein experts check and validate the accuracy and relevance of questions and their answers
	Receiving regular feedback from students regarding the relevance and clarity of questions, and modifying them accordingly
	Involving external experts to check for the alignment of questions with the curriculum
Variable learning curves	Organizing periodic refresher training to help students and teachers become familiar with different aspects of EQBs
	Designing and distributing user guides, frequently asked questions, and video tutorials to clarify common problems
	Creating helpdesk services to promptly address queries
Lack of student engagement	Periodically introducing new features, question formats, or challenges to keep the platform dynamic and engaging
	Obtaining feedback from students on the platform's usability and considering their views on EQB improvement processes
	Exploring the possibility of introducing gamification elements (like leaderboards and achievement badges) to motivate students
Lack of standardization	Encouraging the implementation of standard formats of EQBs across different medical colleges
	Prompting colleges to share their best practices and accordingly move towards standardization
Limited inclusivity	Obtaining feedback from students to ascertain the potential barriers that limit the usage of EQBs
	Introducing features like screen reader compatibility and adjustable font sizes
Security concerns	Implementing secure authentication systems to safeguard the accounts of both students and teachers
	Encouraging the use of encryption protocols to safeguard data transmission and storage
	Regularly updating security protocols
	Liaising with cybersecurity personnel to conduct regular audits and proactively address potential threats
Technological barriers	Training both students and teachers on the features, roles, and responsibilities while using EQBs
	Students should be given access to computer labs or dedicated study spaces with reliable Internet services
	Developing mobile-friendly versions of EQBs to help students who don't have access to laptops or desktop
Limited technical support	Appointing a trained team of personnel or educating technical personnel on different features of EQBs
	Creating helpdesk services to promptly address queries
Financial burden	Clarifying the benefits of EQB to administrators and managers
	Cooperating with other medical colleges to pool resources (if required)

From the student's perspective, resistance to change, variability in the learning curve of different students, and lack of student engagement could be other noteworthy concerns (9). Similarly, even teachers can express their reluctance to shift from conventional assessments to EQBs, expressing security and privacy concerns over the content of EQBs or students' information (10).

Further, with regard to the content of EQBs, concerns include imbalanced questions (both in terms of a tendency toward a specific type of questions like MCQs or in terms of complexity, like a greater number of recall types rather than problem-solving questions), maintenance of the content, especially in the sense of alignment between the questions and recent developments (2, 4, 6). There have been concerns about the lack of measures to sustain quality assurance in EQBs, especially with regard to the accuracy of answers, as well as the relevance and framing of questions (2). There may also be issues such as a lack of standardization of EQBs across different institutions, leading to considerable variations in implementation and processes (7, 8). Finally, the initial setup and infrastructure will warrant lots of financial expenses, and we must think and plan along those lines to ensure that EQBs are effectively implemented (2, 4). There is an immense need to overcome these challenges, and this important task demands a multipronged approach to help educators optimize EQBs (2, 4-7, 9).

Conclusion

In conclusion, EQBs can ensure that medical education is delivered in an innovative manner, which in turn can lead to the graduation of competent healthcare professionals. The need of the hour is to overcome the hurdles interfering with the implementation of EQBs to expand the benefits of this approach for medical students.

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Effect of Group Reflection and Moral Case Deliberation on Moral Reasoning Skills and the Reflective Ability Among Nursing Students

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Abstract

Background: In healthcare, professionals are often confronted with ethical issues and morally complex. Moral reasoning and reflective ability are the most important requirements for nurses' professional proficiency and patient care. Group reflection and moral case deliberation are important and hypothetically impactful forms of clinical ethics support. Empirical evidence, however, is incomplete concerning its real effect.

Objectives: This study aimed to determine the effect of group reflection and Moral Case Deliberation (MCD) on nursing students' moral reasoning skills and reflective ability.

Methods: The present study is quasi-experimental. The nursing students in two nursing faculties of Shahid Sadoughi University of Medical Sciences were enrolled ($n = 72$). The learners participated in the group reflection sessions and MCD in educational intervention. Nursing Dilemmas Test and reflection on learning questionnaires were used. Data were analyzed by SPSS 16 software with repeated measurement ANOVA. The statistical significance is considered at $P < 0.05$.

Results: The results showed that educational interventions improved the moral reasoning skills respectively, Pre-test, 1st post-test, 2nd post-test (44.05 ± 4.79 , 51.63 ± 4.81 , and 50.05 ± 8.47) and reflective ability of learners' respectively Pre-test, 1st post-test, 2nd post-test (59.00 ± 14.48 , 65.71 ± 14.10 , and 67.28 ± 12.60). The results of comparing the intervention and control groups over time showed that the learners' reasoning scores were significantly different ($P < 0.001$), and reflective ability in the intervention and control groups were significantly different over time ($P = 0.003$).

Conclusion: The results indicated the educational effect of interventions on participants' reasoning and reflection was reported at high and moderate levels, respectively. It recommended that interactive methods, including group reflection and moral case deliberation, are planned in the ethical nursing education program.

Keywords: Ethics Reasoning, Reflection, Education, Moral Case Deliberation, Nursing

Background

The development of reasoning and ethical decision-making skills has been considered one of the prerequisites for professional and ethical behavior among staff and students in medical professions (1). Healthcare systems require providers with the capacity and ability to ethically judge (2). The ability to make correct judgments and ethical decisions can potentially lead to achieving health promotion goals, attaining

greater patient benefit, and injury prevention (2, 3). Recently, there has been a growing need to develop moral reasoning skills to improve ethical decisions and professional behaviors among nursing students (4). Moreover, nurses must be able to participate effectively in clinical judgment and ethical decision-making processes (3).

There are two dominant perspectives in designing education programs in the professional field. In the first

perspective, the most important purpose of the programs is to train virtuous personnel. In the second perspective, training is a tool that enables learners to analyze, reason, justify, and make judgments in ethical challenges. In recent decades, one of the important goals in ethics education focused on improving decision-making skills and moral reasoning (5). Moral reasoning was defined as the ability to assess and reflect on ethical challenges, analyze those using rules, justify selecting the best option among different options, and make a decision (6). Moral reasoning skills improve the skills of individuals to determine and select ethical choices in case of encountering ethical challenges (5).

The approaches of clinical ethics support introduced “top-down” or “bottom-up” perspectives with different objectives and methods. The clinical ethics consultation and committees emphasized “top-down” and moral case deliberation, ethics discussion groups, and ethics reflection groups underlined in the “bottom-up” approach. The “bottom-up” approach is highlighted to provide situations for thinking and insight into ethical issues among learners (5). This approach stresses learning through thinking and reflection on their own experiences and their peer about ethical issues in clinical practice (5). Various methods to enhance learners' ethical abilities in education systems have been suggested, such as MCD, reflection-based methods, and group discussions on cases/scenarios (5, 7). In this regard, reflective ability is introduced as the key ability to develop moral reasoning and decision-making skills among learners (1). The reflective ability is defined as one's capacity for questioning and critically analyzing experiences (8) that improve learners' capability to think critically, reasoning, and make ethical decisions (9, 10).

Reflective ability and moral reasoning are the principles of professional behavior (1). MCD and Group reflection have been described as the supportive approach to understanding ethical challenges in clinical practice (5, 11, 12) that can assist health personnel in making decisions in challenging situations. Tan et al. illustrated their experiences with using MCD in the neurology ward. They acknowledged MCD was a practical ‘hands on’ design to deliberate ethical problems. MCD facilitated to foster of understanding of a case and improved decision-making, assisted the participants in preventing moral distress, team construction, and fostering moral competencies. They also suggested that MCD was planned to create a climate for improving the quality of care and improving

workers' knowledge and education (12). MCD positively was evaluated by the participants in Janssens's study. They introduced the effective factors influencing the quality of the MCD sessions, including facilitators as a key role in fostering safety and dialogue among the participants, time, helping follow-up sessions, and management support as bottom-up support (13). Hartman stated although moral case deliberation is evaluated positively as a form of clinical ethics support, it has limitations (14). In a review study concerning the impact of MCD, Haan et al. indicated that most studies reported positive changes. However, challenges, frustrations, and absence of change were also reported (7). Further studies are recommended to illustrate the method's effect on participants' capabilities (7, 14).

Momennasab and colleagues designed the intervention containing four group reflection sessions on ethical codes. Their results showed group reflection improved nurses' knowledge, attitude, and practice based on ethical codes (15). Wati et al. suggested providing consistent ethics training and group reflection sessions to support nurse team leaders in resolving ethical dilemmas, providing a creative environment for ethical decision-making, and improving patient outcomes (16). Morley and Horsburgh explained reflective group discussions in response to morally distressing patient cases and elucidated this supportive process complements ethics consultation. Their results showed the method diminished the adverse effects of moral distress among participants (17). Harrison and colleagues discussed the benefits of group reflection on teamwork and individual practice in clinical practice (18). Most studies addressed the effect of the method on learners' skills, and limited studies assessed the reflective method's effect on participants' reasoning.

Objectives

The present study aimed to assess the effect of group reflection and moral case deliberation (MCD) on nursing students' moral reasoning skills and reflective ability. The hypothesis of this study was to investigate whether the use of group reflection and MCD as teaching methods can improve nursing students' reasoning ability in ethical challenges and their reflective ability.

Methods

Design: This is a quasi-experimental study. This study was conducted at Shahid Sadoughi University of Medical Sciences in 2021-2022.

Participants: Inclusion criteria included participants with at least one semester in clinical education and the ethics course. Nursing participants in two Nursing schools of Shahid Sadoughi University of Medical Sciences were enrolled in the study ($n = 72$) as intervention ($n = 36$) and control ($n = 36$) groups. Based on the schools, the participants were studying in the schools and were entered into the intervention or control groups randomly. In each school, all participants participated in the study by census.

Educational Intervention: The aims of interventions were described as improving the moral reasoning of learners related to ethical challenges. The duration of the interventions was 4 months and was conducted in the nursing schools of Shahid Sadoughi University of Medical Sciences.

The course was conducted in two phases. The interactive lecture reviewed the concepts and principles of ethics and professionalism in the first phase. In the interactive lecture, learners become more involved in learning and retain more information. The interactive techniques such as questioning the audience, using cases and examples and video to direct the learners to participate in the learning process were used.

After that, the MCD sessions were used to develop learners' reasoning and analysis on issues of professionalism and ethics (12). This way, participants were divided into groups of 5-6 persons. They presented their experiences related to ethical challenges as educational cases. The ethical challenges are privacy, conscious consent, patient honesty, colleague relationships, and error reporting. Participants in small groups analyzed the problem and identified ethical questions. The group members could ask questions for additional information about the cases from those who presented them. The members analyzed the cases based on moral values and norms from different stakeholders' viewpoints. The proposed solutions were presented in the small groups in the next step. After that, each group presented their arguments for choosing their solution. Discussion was held between members of different groups to find the best decision. During sessions, the facilitator was responsible for guiding discussion among the learners. Finally, after selecting the best decision and examining its various aspects, the facilitator concluded the discussion.

In the second phase, the group reflection method was conducted. In this section, learners were asked to reflect on one of their experiences in professionalism

and ethics. They filled out a structured form of reflection, including questions based on the Gibbs reflection model (19) (describing the experience (what happened), explaining the pros and cons of the experience, reviewing their performance, and appraising the choice of a better solution and a decision to perform activities in the future. Reflection experiences of learners were shared in small groups, and members discussed their experiences in small groups. After that, the experiences were presented and discussed in larger groups. The facilitator directed the learners in the process of group reflection and summation.

The role of the facilitator was defined as the establishment of a safe climate for an open dialogue that allows the participants to present the case, facilitate discussion, the assistance the participants in reflecting on their experiences, support recognition of ethical issues, determination of the values, the consideration the assumptions and reasoning through a dialogical moral inquiry, and finding the recommendations and best action.

This study used a non-equivalent control group. The participants attended the routine educational sessions where interactive lectures taught principles of ethics and professionalism. The techniques, including using cases and examples and video, were used in the sessions to teach the principles of ethics and professionalism.

Measurements: The Nursing Dilemmas Test consists of 6 scenarios of ethical challenges for patient care, including "Newborn with anomalies," "Forcing medication", "Adult's request to die", "New nurse orientation", "Medication error," and "Uninformed terminally-ill adult". The questions assessed the nurse's reaction in that simulated situation. The questionnaire was developed by Chrisham based on Kohlberg's theory (20). Each scenario suggests a situation that can be problematic for nurses. Each scenario has six common views, which are presented through six questions. The NDT yielded 4 scores: willingness to act, familiarity, practical considerations, and principled thinking. The possible total scores of each scenario and all six scenarios are respectively 11 and 66, with lower scores showing lower moral reasoning ability. Crisham found the test reliable (Cronbach's $\alpha=0.57$) and valid on the Kohlberg-like scale (21). Borhani et al. confirmed the Persian version, face, and content validity. They also reported a test-retest correlation coefficient of 0.82 by twice applying the test to ten nursing students and nurses (22).

The “reflection on learning” questionnaire was developed by Sobral et al. (23). The reflection-in-learning is a powerful predictor of change in moral reasoning over time. The questionnaires consisted of 14 items, and the scoring was from 1 (never) to 7 (always) (1). The range of scores was from 14 to 98. Validity and reliability were confirmed in the author's investigated context in the previous study. (Cronbach's alpha = 0.92, ICC=0.90) (24). Participants completed the questionnaires one week before the start of the intervention (i.e., baseline), one week after intervention completion (i.e., post-intervention), and two months after intervention completion (i.e., follow-up) in both the intervention and control groups. They filled out the questionnaires by self-administration in the schools' face-to-face survey.

Data Analysis: Data were analyzed by SPSS 16 software. Data was analyzed by descriptive (frequency and percentage, mean, SD) and analytical tests. The RM-ANOVA test was used to examine the moral reasoning change and the reflective ability of participants over time in the intervention and control groups. The Partial eta-squared (η^2) index evaluated the effect of the intervention. Based on the Partial eta-squared (η^2) index, the educational effect of 0.01 was low, 0.06 was moderate, 0.14 was high, and statistically significant of the repeated measure ANOVA was considered $P < 0.05$.

Results

Learners: 55.6% male (n=40) and 44.4% female (n=32). The age range of learners was 19 to 23 years.

Instructors: two experts in nursing education who have experience in teaching professionalism and ethics in nursing participated in the study.

The reasoning scores of learners in the intervention and control groups are shown in Table 1. The results indicated the moral reasoning scores in the intervention group were improved. Bonferroni test showed the learners' scores of moral reasoning before and after one week ($P = 0.00001$) and after two months ($P = 0.00001$) had significantly improved. There was no significant difference between the one-week and two-month post-tests. We found no significant interaction effect between the learners' scores of moral reasoning and their gender and their age in intervention and control groups over time. The trend of moral reasoning and reflective ability scores of participants in the intervention and control groups over time are shown in Figures 1 and 2.

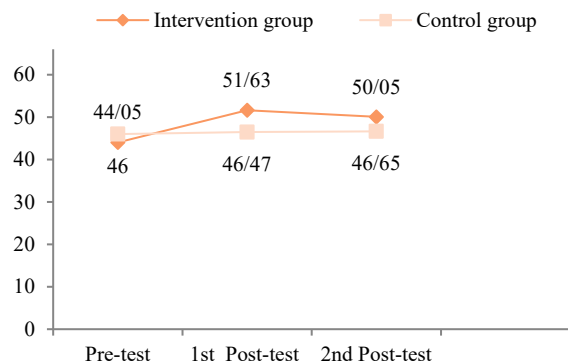


Figure 1. The results of the moral reasoning of participants in the intervention group over time

The reasoning scores of participants about ethical dilemmas such as “Newborn with anomalies”, “Forcing medication”, “Adult's request to die”, “New nurse orientation”, “Medication error,” and “Uninformed terminally-ill adult” was improved after the intervention.

The reflection ability scores of participants in the intervention and control groups are shown in Table 2.

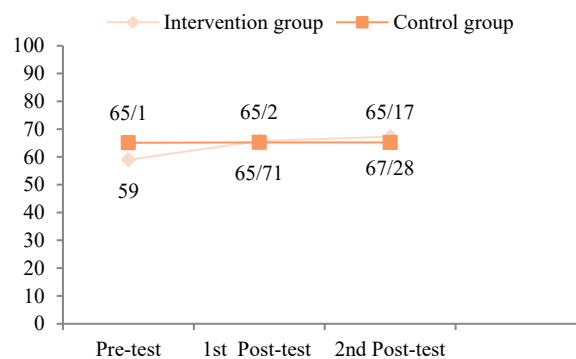


Figure 2. The reflective ability of participants in the intervention and control groups over time

The results indicated the reflective ability of participants in the intervention and control groups improved over time. We found no significant interaction effect between the learners' scores of reflective ability on the intervention and control groups over time and their gender and age.

The interaction of moral reasoning and reflective ability: The results showed the relationship between participants' moral reasoning and reflective ability was significant. We found a significant interaction effect between the learners' scores of moral reasoning and reflective ability one week ($P=0.0001$, Partial eta-squared (η^2) = 0.94) and two months after the intervention (P -value=0.0001, Partial eta-squared (η^2) = 0.94), respectively.

Table 1. The reasoning scores of learners in the intervention and control groups

Group	Pre-test		1 st post-test		2 nd post-test		p-value	Partial eta-squared (η^2)
	Mean	SD	Mean	SD	Mean	SD		
Intervention	39.14	4.83	51.54	4.84	49.71	8.34	0.00001	0.36
Control	46.00	7.22	46.47	7.17	46.65	7.46		

Repeated Measurement ANOVA

Table 2. The reflection ability scores of learners in the intervention and control groups

Group	Pre-test		1 st post-test		2 nd post-test		p-value	Partial eta-squared (η^2)
	Mean	SD	Mean	SD	Mean	SD		
Intervention	57.00	14.84	65.71	14.10	67.28	12.60	0.003	0.07
Control	65.10	13.28	65.20	13.26	65.17	13.26		

Repeated Measurement ANOVA

Discussion

The development of reasoning skills and reflective ability among participants are recognized as essential skills in professional behavior (1). The results of this study displayed that the use of MCD and group reflection methods in clinical education improved the participants' moral reasoning skills and their reflective ability over time. The results indicated that the educational effect of interventions on participants' reasoning and reflective ability was reported at high and moderate levels, respectively. Due to the increasing complexity of clinical environments, the probability of nurses facing ethical challenges has increased significantly, so nursing students must acquire the ability to reason and make ethical decisions during their careers, the use of methods based on group discussion and case-based learning methods have a positive impact on the reflective ability and reasoning of students.

Nursing learners should be prepared to enter the complex clinical environment and learn how to manage situations of ethical challenges (3, 25). They need to develop and improve ethical analysis skills and decision-making capabilities to manage ethical problems in clinical situations and make ethical decisions (4, 6). The results of the study indicated the scores of moral reasoning of participants in the control group and before intervention were at a moderate level.

Moral reasoning involves reflecting professional values about each possible action and considering the impact of potential decisions on patient well-being (26-29). The MCD is as collaborative and systematic reflection on real clinical cases (5) focused on improving learners' problem-solving skills and decision-making processes in ethically challenging situations. This present intervention allowed learners to practice ethical decision-making by analyzing challenges and dilemmas and appraising different approaches. In addition, the

individual and group reflection sessions were provided the structured reflection-based learning opportunities so learners could learn ethical decision-making paths by reviewing, analyzing, and reflecting on their own and peer experiences. In line with our results, studies showed that discussing ethical questions or challenges increases learners' reasoning skills by listening, asking questions, thinking about ethical challenges/problems, and decreasing quick judgments (7, 30-32). Discussing ethical questions and reflecting on individual and team performance to solve the ethical dilemmas improved the learners' understanding of ethical responsibilities (5, 33, 34). They enhanced their sensitivities in dealing with ethical challenges. Moral sensitivity enables learners to understand the situation, respond appropriately, and seek a moral solution (35). Likewise, Haan's review study results showed that MCD has changed the behavior and skills of learners in ethical challenge situations (7). The results of the Mixed-method study showed that using the MCD method increased participants' ethical abilities, including their understanding of the actions, exploring the different aspects of a situation, reasoning and finding a way to manage a situation, and improving the ability to reflect (36).

The results of our study showed an improvement in moral reasoning scores about ethical dilemmas such as "newborn with anomalies", "forcing medication", "request to die", "new nurse orientation", "medication error," and "uninformed terminally-ill adult" among learners resulted in they learned the process of reason and reflection their learning in new situations. Similarly, MCD helps learners improve their ethical reflection skills (34), which was confirmed in the present study. Likewise, the results of the study by Namadi et al. showed that using case in ethics training could significantly increase the level of moral reasoning of nursing participants (37), similar to the present results.

The Rasool review study highlighted reflection as one of the supportive strategies for developing moral skills (5). Group reflection emphasizes the discussion of the experienced ethical challenges by learners to improve ethical performance and professional development among health personnel (38). Reflection-based learning leads learners to encourage ethical reflection in clinical settings and reduce ethical errors (38-40). Ethical case analysis, group discussion, and ethical reflection improve learners' understanding of ethical challenges by enhancing learner engagement and seeking the best solution (5). Rasool's study emphasized long-term group reflection sessions to develop learners' skills in finding the best approaches for managing ethical challenges in clinical settings (5). Similarly, the present results showed that group reflection improved clinical reasoning and reflective ability among learners over time.

Reflective ability is introduced as one of the most important elements in providing value-based services in the health care system (41). Reflection is a metacognitive process defined as occurring before, during, and after a person's situation or action (42). The reflection-in-learning is suggested as a powerful predictor of change in moral reasoning over time (1). Our study's results confirmed the relationship between the participants' moral reasoning and reflective ability. The results of a descriptive study showed no significant relationship between learners' moral reasoning and their ability to reflect (43), which is different from the present results and the results of the cohort study of Chalmers (1). The results of the Chalmers study showed that learners' ability to reflect and reason is diminishing over time in medical education. They showed that the improvement in participants' reflective ability was significantly correlated with their moral reasoning (1).

Similarly, the current results showed that the educational interventions were effective in improving the ability of both reflection and moral reasoning of learners in the intervention group compared to the control group. In the current educational interventions, the process of reflection on real situations and experiences of learners in ethical challenges in different fields has been considered. The participants practiced the process of reflection on individual or group experiences that resulted in they applied their ability in different situations over time. Reflection improved people's awareness of the various aspects of ethically challenging situations and how they are managed in the clinical situation (34).

Moreover, it affects the development of learners' moral skills (41), which is in line with the present results. The implementation of longitudinal group reflection sessions has an impact on the development of reflective ability (38). The intervention's moderate educational effect on participants' reflective ability may be due to the short-term intervention. Further study is suggested to assess the effect of the long-term intervention on the reflective ability and moral reasoning of learners.

Limitations: The quasi-experimental design in the present study suffered some limitations, such as non-randomization and non-equivalent control group, which limited the generalizability of results. The present interventions were not implemented as a longitudinal course, limiting the present study. It is recommended to design longitudinal courses through applying a reflection-based learning approach.

Conclusion

Moral reasoning and reflective ability are essential in developing professional behavior in the health care system. The results indicated that the educational effect of interventions on participants' reasoning and reflection was reported at high and moderate levels, respectively. The findings showed that intervention included group reflection, and MCD improved moral reasoning skills and the reflective ability of nursing participants. Establishing mechanisms of clinical ethics support and reflection-based learning situations is recommended to develop participants' reflection skills and moral reasoning in health care systems.

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Professional Dental Education in the Modern Russian Federation: Current Status and Prospects

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Abstract

Background: In the Russian Federation, dentistry has become a very popular career choice among applicants, leading to a significant increase in the number of graduates from dental faculties and universities, as well as a growth in the number of educational institutions providing higher medical education in dentistry.

Objectives: The aim of this study was to review the current status, requirements, and prospects of dental education in the Russian Federation.

Methods: Statistical, informative, and analytical official reports in Russia, as well as foreign information sources, cross-sectional studies, and the data on official websites of higher education institutions were analyzed.

Results: In the Russian Federation, there has been an increase in the number of dental universities and faculties, as well as the number of dentistry students over the past 10 years. There is a surge in the number of admitted students, the number of dentists graduating from universities, and clinical residents of dental specialties. At the same time, the tuition fees are the highest for all specialties and are going up every year. There is also an increase in the total number of dentists, and they are concentrated in Moscow and other big cities in the country.

Conclusion: Currently, in the Russian Federation, we can speak of the skewness of medical education toward dentistry. To meet the challenges facing dentistry, it seems reasonable to match the future dental workforce with the future needs of the population. The current situation in the healthcare system of the Russian Federation needs to be improved for medical dentistry education and dental health staffing, and all these issues can only be solved by introducing fundamental changes.

Keywords: Dentistry, Dentist, Medical Education, Health Care Policy, Russian Education

Background

The aim of medical education is to prepare physicians to deliver the fundamental values of medicine and embrace a deep sense of duty and commitment to their patients. Medical education practice varies from country to country (1-3). Medical education has eventually evolved into a process involving three discernable stages, including specialized, postgraduate, and continuous education (1-3).

In most countries, the dental education system begins after secondary school, and the dentistry course usually lasts at least five years (4). Historically, two main models of dental education are recognizable: odontology and dentistry. Odontology-based curricula are primarily oriented toward the oral cavity and maxillofacial region, whereby dental students may focus less on specific body systems and more on the head and neck. In turn, the "dental approach model" is based on studies on the oral cavity and its diseases in

the broader context of overall human health and disease. In educational systems based on the "dental model", students are educated alongside medical students using a common curriculum that includes basic sciences and clinical disciplines in medicine, where the technical and clinical aspects of dentistry are often not learned until the fifth year of study. This results in additional curriculum hours being devoted to recognizing and treating whole-body diseases rather than focusing on oral problems. Both educational models have strengths and weaknesses. The "dental model" emphasizes an intermediate approach and studying and treatment of common diseases of the body. With a stronger medical background, dentists are likely to interact better with physicians, delivering joint efforts of general practitioners and dentists more effectively. However, the disadvantage is that dentistry students who study general medicine may lose the precious time to learn adequate and basic technical topics of dentistry (4, 5). Educational organizations in North and South America, Western Europe, Japan, India, and Australia more commonly use the odontological model and recognize dentistry as an autonomous discipline. In contrast, the "dental model" of education is more common in Eastern Europe and China, where dentistry is more commonly seen as a specialty of general medicine (4, 5).

In recent years, the Russian Federation has seen an increase in the number of dentists, who tend to concentrate in large cities of the country (6, 7). Rakova T. is studying personnel policy in the healthcare sector and believes that there is an oversaturation of the market for dental services in the private medical sector (7).

Some Russian scientists suggest that over the next few decades, the dental industry will experience a labor surplus, which will create economic problems for both doctors and dental clinics (7, 8).

The same problem is shared with other countries. For example, Cheng F. wrote about the status of Taiwan and the imbalanced geographic distribution of dentists across that region (9). The continuation of the current expansion of dentists' staffing capacity may exaggerate this imbalanced geographic distribution, so a mechanism must be in place to control the overall number of dentists to avoid escalation of these problems.

Gabriel M. and Cayetano M. studied the issue of geographical distribution in Europe (10) and highlighted the geographic disparities of dentists as a challenge for healthcare systems. After all, staff policies

have a direct impact on access to dental services and public oral health. Personnel policy and training of specialists are interrelated and should be taken into account in this complex situation.

Objectives

The aim of this study was to review the current status of dental education, as well as its requirements and perspectives in the Russian Federation.

Methods

This was a descriptive comparative study focusing on analyzing primary data collected from the official web pages of Russian governmental organizations. Scientific publications and articles on this topic were also scrutinized. Other data resources included statistical analytics and materials published in Russian and foreign news agencies, statistical reports of the Ministry of Health of the Russian Federation, Federal State Statistics Service (Rosstat), Federal State Budgetary Institution, and the Central Research Institute for Organization and Informatization of Health Care of the Ministry of Health of the Russian Federation. Analyses of the dynamics of enrollment and graduation of dental students were also reviewed.

Results

Overview of the Russian Federation's Geographical and Demographic Status

The Russian Federation is geographically one of the largest countries in the world, encircling 11 time zones, 8 federal districts, and 89 entities consisting of republics, regions, cities of federal subject significance, and autonomous regions. However, the population of 145 million people for such a large territory is relatively small and concentrated mainly in the European part of the country, where there are differences in access to medical care and the distribution of human resources working in the healthcare sector (11, 12). The capital Moscow is the largest city with a population of approximately 13 million (13, 14).

Evolution of Dental Education in the Russian Federation

Higher education in the Russian Federation in dentistry is recognized as a specialty (1, 3). Training is provided by academies, universities, institutes, and other educational institutions and organizations (3, 13).

Dental education can be obtained at the expense of the state (free of charge) if there are free positions in the higher education institution. Also, education in some institutions requires paying a fee by students or

their parents. In addition, the Russian higher education system provides a targeted dental training opportunity at the expense of a particular organization that pays for the course. After graduation, the graduate will have to work in the same organization for at least 3-5 years (1, 3, 15).

In the Russian Federation, medical and pharmaceutical personnel are trained in 62 higher education organizations under the jurisdiction of the Ministry of Health of the Russian Federation, 45 medical faculties affiliated with classical universities under the jurisdiction of the Ministry of Education and Science of the Russian Federation, and private educational organizations (1, 3, 13) (Figure 1).

The medical education system in the Russian Federation is regulated by "Federal Law No. 273 on Education in the Russian Federation" issued on 29 December 2012 and "Federal Law No. 323 on the Fundamentals of Health Protection of Citizens in the Russian Federation" pronounced on 21 November 2011. The "Federal Law No. 273" determines the need to observe the continuity of the educational process (3, 15, 16).

Regarding today's medical education in the Russian Federation, the following important changes have taken place and are taking place:

- Since 2013, the introduction of professional standards
- Since 2011, cancellation of internships for general practitioners
- Since 2016, the replacement of certification of doctors by accreditation
- Since 2013, the implementation of a continuous medical education program

In accordance with the "Federal Law No. 273-FZ, 29 December 2012, on Education in the Russian Federation", the medical education system is carried out on the basis of "Federal State Educational Standards" and "Federal State Requirements", which assume the followings:

Uniformity of the territorial educational space across the Russian Federation

- Integration of basic educational programs
- Variations in the content of educational programs corresponding to different educational levels
- State guarantee of ensuring the standard level and quality of education based on the uniformity of mandatory requirements for the implementation of basic educational programs and assessment of their outcomes (3, 15, 16).

Requirements for Dental School Admission

Admission to dental faculties and universities is a process designed to select students who are capable of obtaining a diploma in dentistry and possessing the qualities to become a full member of the medical profession. There is no unified or special system for admission to dental and medical higher education institutions in the Russian Federation. As a rule, secondary school graduates enter through the Unified State Examination (USE). For admission to a dental or medical specialty, it is necessary to obtain minimum passing scores in three subjects: Russian language, chemistry, and biology. Higher education institutions may set their own criteria for minimum scores (3, 15, 16).



Figure 1. The location of dental education institutions in the Russian Federation, adopted from (1)

Also, in addition to the USE, points obtained by participation in conferences, Olympiads, competitions, etc. are counted. At the same time, the quality of admission to higher education institutions is assessed by the minimum passing scores obtained in the USE and the average scores of applicants admitted to medical and dental universities. For foreign students, instead of the USE, applicants are offered to take special entrance exams to universities (3, 15, 16).

Dental School Curricula

Dentistry education in the Russian Federation encompasses a five-year full-time study program.

After completing this educational program, a graduate should also pass the initial accreditation in the specialty of dentistry, which consists of three stages: testing, performing practical tasks in simulated conditions, and solving situational tasks in the format of electronic cases. After this examination, the specialist can take the position of a dentist and carry out his/her professional activities in accordance with professional standards. The graduate can also continue his/her training in residency to master a narrower specialty (1, 3, 16) (Figure 2).

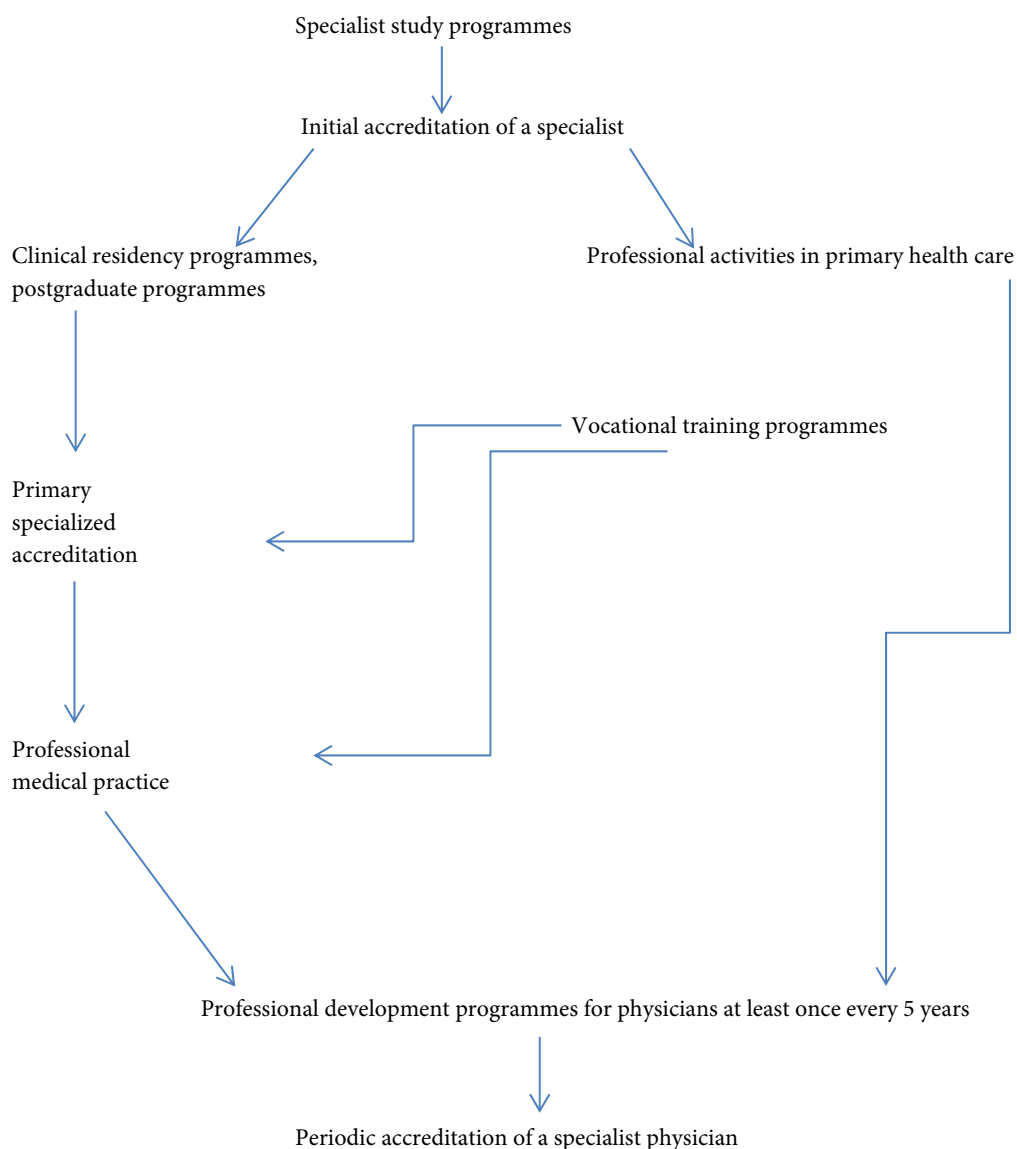


Figure 2. Schematic demonstration of the main stages of higher medical, postgraduate clinical and continuing professional education in the Russian Federation, information source (3, 16)

Staff training in the residency course of dental specialties is carried out in seven areas: pediatric dentistry, orthodontics, orthopedic dentistry, therapeutic

dentistry, general practice dentistry, surgical dentistry, and maxillofacial surgery (3, 16) (Table 1).

Table 1. Dental specialties, qualifications, and positions in the Russian Federation, adopted from (3, 16)

Dental specialties in the Russian Federation	Qualifications and positions
Pediatric dentistry	Pediatric dentistry, growth and development
Orthodontics	Orthodontics
General practice dentistry	General dentistry
Oral and maxillofacial surgery	Oral and maxillofacial surgery, periodontics, oral implantology
Surgical dentistry	Periodontics, oral implantology, surgical dentistry
Prosthodontics	Prosthodontics, cosmetic dentistry, maxillary orthopedics
Therapeutic dentistry	Endodontics, periodontics, aesthetic and restorative dentistry, cariology

Increase in the Number of Dental Students and Dentists

In the last few years, applicants have faced an increase in tuition fees compared to prior years, yet enrollment in universities continues to grow (1, 3). The demand for higher medical education in dentistry can be explained by the asymmetry of information related to the value of expected wages, the number of higher education graduates on the market, the unemployment rate among university graduates, and perspectives of human capital development considering higher medical education as an investment (1, 3, 17) (Figure 3).

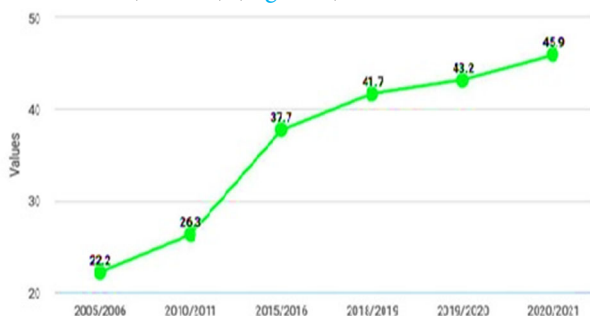


Figure 3. Total number of students enrolled in dentistry (thousand people), adopted from (3, 13, 18)

In the Russian Federation, there has been an increase in the number of dental universities and faculties along with the number of dental students enrolling in them (3, 13, 18) (Figure 4).

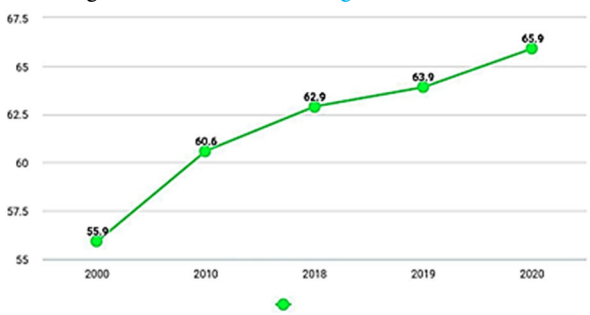


Figure 4. Total number of dentists in the Russian Federation, information source (3, 13, 18)

The community of physicians includes those acquiring higher medical education and employed in medical and preventive organizations, consumer protection and welfare services, social security institutions, medical clinics affiliated with higher education institutions, research institutes, educational institutions, etc. In terms of the total number of doctors in the Russian Federation, dentists are ranked in third place after general practitioners and surgeons (3, 15, 18).

In accordance with the "Order of the Ministry of Health of the Russian Federation No. 786n" approved on 31 July 2020 on "Approval of the Procedure for the Provision of Medical Care to the Adult Population for Dental Diseases", the recommended staffing levels are 5 doctors per 10,000 population (3, 13, 15). The general trend is a steep growth rate in the number of dentists compared to that of doctors in other specialties (3, 13, 18) (Figure 5).

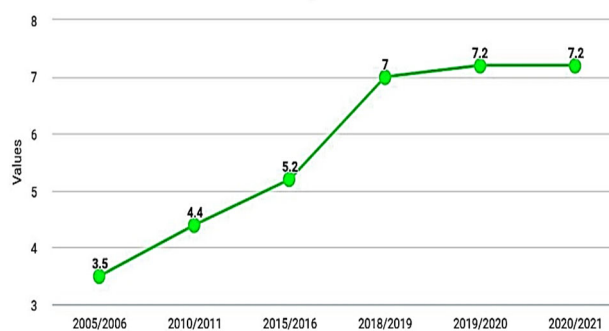


Figure 5. The number of graduated dentistry specialists (thousands of people) in the Russian Federation, information source (3, 13, 18)

Graduation from Dental Schools

After graduation from dental schools, students should pass the initial accreditation of specialists, which includes three steps:

- Testing: to assess the formation of knowledge and skills required to perform professional skills and competencies

- Assessment of practical skills (abilities) in simulated conditions: to assess graduates' practical skills in professional activity in accordance with the requirements of dentistry professional standards.
- Solving situational tasks in clinical medical situations (1, 3, 16).

Discussion

All over the world, not only in economically developed countries but also in developing countries, higher education is democratizing and becoming more accessible to most people. The aims and objectives of higher education have changed significantly over the decades. Medical universities have transformed from elitist organizations to mega institutions (3, 17). The rapid spread of higher education has brought mass character, commercialization, and inequality but has failed to trigger social mobility (17).

An increase in the size of the population, population aging, the importance of dental health and oral hygiene, and the close relationship between dental problems and general systemic diseases have increased the need and demand for dental services, requiring the creation of new dental educational institutions in many countries (3). However, demographic trends in the Russian Federation, including the low population growth, a significant lag in life expectancy (both in economically developed and developing countries), poverty, and uneven geographical distribution of the population and access to dental and medical services have resulted in a difference between people living in Moscow vs. other regions, as well as between people living in cities vs. those residing in villages in terms of living standards and access to quality medical care (3, 12, 14).

At the same time, the main factors contributing to the successful development of the market of paid dental services are standard living conditions, income growth, and the well-being of the population. However, Russia has been experiencing a decline in the true income of its population since 2014 (12, 14).

In recent years, there has been an increase in the number of dental universities and faculties across the Russian Federation, and in parallel, an increase in the number of dentistry graduates and dental students admitted. However, the number of applicants outweighs the capacity of the higher education system, and the costs of education are quite high. Despite this, applicants to medical schools have a great interest in this particular specialty due to the general opinion that

dentistry is the most prestigious and highly paid profession. A similar situation is observed in Canada. According to the 2016 Canadian Census, about 19.4% of all Quebec residents live in rural areas, while according to survey data, a significantly larger number of general dentists and professionals (90.3%) reside in the urban areas of Quebec. Apparently, the industry has an oversupply of specialists in large cities and a shortage in remote areas (10, 19). Scientists from the United States have expressed their concerns over the current situation of training dentists. Dental schools are releasing new dentists at a faster pace than the population growth. Three factors are especially important: 1) improved oral health; 2) reduced costs per patient per year, giving dentists an incentive to treat more patients to maintain revenues justifying their investment in dental education and practice; and 3) the inflow of new dentists at a faster rate than the population growth. If these trends continue, dental surges are likely to be between 32% and 110% by 2040. The main task of dental schools should be to establish the release of dentists until 2040 and not to wait until market forces reduce the surplus (19).

Conclusion

Health managers should plan to balance the composition and selection process of healthcare staff in the future to avoid shortages in one area and the overflowing of specific specialties on the other side.

The lack of appropriate human resource policies in many countries is the cause of chronic imbalance and multifaceted public health consequences: quantitative mismatch, qualitative mismatch, uneven distribution, and lack of coordination between actions and health needs. The Russian medical education system is on the threshold of reforms. Medical education, including higher and secondary education, is closely related to staff policies in the sphere of health care. When planning the training of medical specialists, it is recommended to take into account the staffing needs of different regions of the Russian Federation and the large size of some territories, as well as differences in demographic features, morbidity rates, utilization of medical services, etc. Education and healthcare managers should pay attention to the rates and types of admissions to medical universities and faculties, postgraduate clinical education fields, and employment of medical graduates. Also, another relevant issue is the quality of training of medical specialists, compliance of

training programs with modern healthcare, professional competency of doctors, etc.

Personnel policies in the sphere of Russian healthcare can be revised to take into account these issues. It is advisable to pay attention to successful international experiences in medical education and healthcare personnel policies in other countries. Key issues in human resource management in healthcare are to have systemic and comprehensive solutions at the federal and regional levels and long-term planning.

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Perspectives of Emergency Medical Technicians on the Integration of Medical Science Education in Prehospital Emergency Care in Iran: A Thematic Analysis Study

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Abstract

Background: Prehospital emergency care plays a vital role in the healthcare system and can significantly affect the outcomes of patients. Integrating medical science education into Emergency Medical Technicians (EMTs) training programs could improve prehospital emergency care and patient outcomes.

Objectives: The present study was conducted to explore the perspectives of Iranian EMTs on integrating medical science education in prehospital emergency care.

Methods: This study was a qualitative descriptive design in Iran. Using the purposive sampling method, data were collected through in-depth individual interviews with 13 EMTs who had completed EMT training programs in Iran. Thematic analysis, a form of qualitative content analysis, was used to identify key challenges and barriers to integrating medical science education, as well as potential benefits and opportunities.

Results: After multiple rounds of analyzing and summarizing the data and considering similarities and differences, 2 main categories and 6 subcategories were created based on the results of the data analysis, including: "inadequate training" and "lack of ongoing training and professional development opportunities".

Conclusion: The study highlights the importance of stakeholder collaboration and communication to develop effective EMT training programs. Integrating medical science education in EMT training programs could improve the quality of prehospital emergency care and, ultimately, the health outcomes of patients.

Keywords: Integration of Medical Science Education, Emergency Medical Technicians (EMTs), Prehospital Emergency Care

Background

Prehospital emergency care is a crucial component of the healthcare system and plays a significant role in determining patient outcomes (1). Emergency medical technicians (EMTs) serve as the first responders in many emergency situations and are responsible for providing prehospital emergency care to patients (2). However, the quality of EMT training in Iran is often inconsistent, and many EMTs lack the necessary skills and knowledge to

provide effective care (3). The integration of medical science education into EMT training programs in Iran can potentially improve the quality of prehospital emergency care and, ultimately, the health outcomes of patients (4, 5).

In pre-hospital emergency care, education plays a pivotal role in equipping healthcare professionals with the knowledge and skills necessary to provide effective and timely care. It encompasses various educational

methods, including didactic lectures, practical training sessions, simulation exercises, case-based discussions, and continuous professional development programs (6). The role of education in improving the health system, particularly in pre-hospital emergency care, cannot be overstated. By providing comprehensive and up-to-date medical knowledge, education ensures that healthcare professionals are well-prepared to respond to emergencies, make accurate diagnoses, and initiate appropriate interventions promptly. Moreover, education cultivates essential skills such as effective communication, teamwork, and leadership, which are crucial for delivering high-quality pre-hospital care (7-9). Medical education specifically tailored to pre-hospital emergency care plays a significant role in strengthening the medical emergency system. It focuses on topics such as emergency assessment, triage, resuscitation techniques, trauma management, and the administration of life-saving medications. By receiving comprehensive medical education, healthcare professionals are better prepared to handle a wide range of emergencies and make informed decisions regarding patient care. This improves patient outcomes and contributes to the overall effectiveness and efficiency of the pre-hospital emergency system (10).

Despite the potential benefits of integrating medical science education into EMT training programs, its implementation has several challenges and barriers. These challenges include a lack of resources, a shortage of trained healthcare professionals, and limited access to continuing education and professional development opportunities (11, 12). In addition, cultural and social factors may impact the implementation of medical science education in EMT training programs (13). The field of EMS and prehospital emergency care in Iran lacks sufficient studies. There is a need for more research to address the gaps in knowledge and understanding of this field. Specifically, in the context of integrating medical science education into prehospital emergency care, the literature is limited, and further studies are required to explore this area comprehensively.

Qualitative studies play a crucial role in addressing gaps and challenges in EMS education and prehospital emergency care by providing a deeper understanding of the experiences, perceptions, and behaviors of emergency medical technicians (EMTs) and other stakeholders in the field. These studies explore the "how's" and "whys" behind phenomena, capturing nuanced information that quantitative research may not

reveal. They offer valuable insights into EMTs' perspectives, identify knowledge gaps and areas for improvement in EMS education programs, and provide a comprehensive understanding of the challenges and opportunities in integrating medical science education in prehospital emergency care. Moreover, qualitative research complements quantitative analysis by expanding and deepening the understanding of data obtained from quantitative studies, providing a more holistic view (14, 15).

The study aimed to explore the perspectives of Iranian EMTs on the integration of medical science education in prehospital emergency care. The findings of this study have implications for the development and implementation of EMT training programs in Iran and other countries. By identifying the challenges and barriers to integrating medical science education, this study can inform the development of effective strategies for improving the quality of prehospital emergency care and, ultimately, the health outcomes of patients.

Objectives

The present study was conducted to explore the perspectives of Iranian EMTs on integrating medical science education in prehospital emergency care.

Methods

This study employed a qualitative descriptive design to explore the perspectives of EMTs on integrating medical science education in prehospital emergency care in Iran. Qualitative description is a research approach used in qualitative studies to provide descriptive accounts of phenomena in the healthcare and nursing. It is particularly useful for investigating poorly understood phenomena, discovering details about events or experiences, and gaining insights from informants. Qualitative descriptive design is commonly employed when the aim is to obtain a straightforward description of a phenomenon or to inform the development of questionnaires or interventions. It is recognized as an important and appropriate research tradition for addressing research questions about the "who, what, and where" of events or experiences (16, 17). Semi-structured interviews were conducted with a purposive sample of EMTs who had completed EMT training programs in Iran. The interviews were audio-recorded, transcribed, and analyzed using thematic analysis.

Participants: The participants in this study were EMTs who had completed EMT training programs in

Iran. A purposive sampling strategy was used to select participants with a range of experiences and perspectives on integrating medical science education in prehospital emergency care. The eligible participants to enter this study were emergency medical technicians (EMTs) who had completed EMT training programs in Iran. The researchers used a purposive sampling strategy to select participants with a range of experiences and perspectives on integrating medical science education in prehospital emergency care. The participants' work history was considered an essential criterion in the selection process. EMTs with varying years of experience and from different prehospital emergency care settings were included to capture a comprehensive range of perspectives.

Data Collection: Semi-structured interviews were used to collect data from the participants. The first author conducted the interviews. The interviews were conducted in Persian by a trained interviewer fluent in the language and familiar with the culture. Interviews were audio-recorded and transcribed verbatim after each session. The interview questions were designed to explore the participants' perspectives on integrating medical science education in prehospital emergency care in Iran. They included open-ended questions to encourage participants to share their experiences and thoughts. The inclusion criteria consisted of EMTs who had at least 2 years of experience in the relevant field, EMTs who were currently employed full-time and willing to share their experience

Data Analysis: Thematic analysis was employed to analyze the data in this study, allowing for identifying patterns and themes in qualitative research. This method facilitated a comprehensive exploration of the data's intricate details. It was particularly suitable for examining key issues within specific groups or individuals, as in health research projects (18). The analysis began by thoroughly familiarizing ourselves with the transcribed data and noting initial ideas, followed by systematic coding of noteworthy aspects. Two researchers independently reviewed and organized the codes into potential themes. Through comparisons across the dataset and constructing a thematic map, the researchers identified and refined the themes and subthemes. An iterative approach was adopted, ensuring ongoing refinement of each theme and subtheme for accuracy and coherence while aiming to uncover the overarching narrative within the data. Thematic analysis enabled a deeper understanding of the perspectives of Emergency Medical Technicians on integrating medical

science education in prehospital emergency care in Iran by uncovering and interpreting the salient themes that emerged from the interviews.

Rigor: The study's findings were validated by diversifying the participants in terms of their age, gender, work experience, and extended involvement with them, as well as through member- and peer-checking techniques. Moreover, the outcomes were shared with 2 EMTs who were not part of the study, and they were requested to compare them with their own work experiences. To conduct peer-checking, the codes and themes derived from this study's findings were presented to 2 qualitative research specialists, who verified the accuracy and consistency of the data with the codes and categories. Transferability was ensured by providing detailed descriptions of the data and research process, enabling readers to assess the accuracy and relate the findings to their contexts. Additionally, to guarantee dependability in this study, 2 external observers were invited to evaluate and endorse the data collection and analysis procedures. The involvement of external observers aimed to minimize potential biases and increase the study's objectivity. Being unfamiliar with the phenomena under investigation, these observers could provide impartial evaluations of the research process. All the obtained data were thoroughly documented throughout the study as a comprehensive report to validate the research.

Results

The study involved 13 EMTs, aged between 25 and 45 years old, with a minimum of 1 year of work experience. 7 EMTs had bachelor's degrees, and 6 had associate's degrees. Table 1 presents the participants' characteristics in more detail. Upon analyzing the data, approximately 563 initial codes were extracted from the interviews.

These codes were reviewed multiple times and grouped based on their similarity and proportion. Four primary categories emerged from the interviews: "inadequate training" and "lack of ongoing training and professional development opportunities". The data analysis process also yielded 6 subcategories, which fell under the four main categories (Table 2).

1) Inadequate Training

Many EMTs felt that their training programs did not adequately prepare them for the realities of prehospital emergency care, particularly in rural areas.

Table 1. Characteristics of the Study Participants (n=13)

ID	Gender	Age (year)	Working experience (years)	Education level
P1	Male	30	4	Bachelor's Degree
P2	Female	35	8	Associate's Degree
P3	Male	25	2	Bachelor's Degree
P4	Male	40	15	Associate's Degree
P5	Female	28	3	Bachelor's Degree
P6	Male	32	6	Associate's Degree
P7	Female	27	2	Bachelor's Degree
P8	Male	45	13	Associate's Degree
P9	Female	29	4	Bachelor's Degree
P10	Male	37	10	Associate's Degree
P11	Female	26	1	Bachelor's Degree
P12	Male	42	12	Associate's Degree
P13	Female	31	5	Bachelor's Degree

They expressed concerns about a lack of hands-on experience, inadequate exposure to diverse patient populations, and insufficient communication skills and cultural competence training.

Table 2. The Key Themes and Sub-Themes

Key Themes	Sub-Themes
Inadequate training	Lack of hands-on experience
	Inadequate exposure to diverse patient populations
	Insufficient training in communication skills and cultural competence
Lack of ongoing training and professional development opportunities	Lack of access to continuing education programs
	Lack of regular feedback and evaluation
	Limited opportunities to learn from and collaborate with other healthcare professionals

A) Lack of hands-on experience: Participants felt that their medical science education did not adequately prepare them for real-life situations in the field. They

noted that they lacked hands-on experience and practical training. P6 shared "We don't have enough practical training. We learn the theory, but when we go into the field, we're unsure what to do."

B) Inadequate exposure to diverse patient populations: Participants reported not receiving sufficient training to handle patients from diverse backgrounds. They felt that their education did not adequately prepare them to interact with patients from different cultures or with different medical conditions. "Our training only focused on the basics. We weren't taught how to handle patients from different cultures or with different medical conditions." (P.10)

C) Insufficient training in communication skills and cultural competence: Participants felt that their education did not provide enough training in communication skills and cultural competence. They noted that these skills are crucial when working with patients and can affect patient outcomes. "We need more training in how to communicate with patients. It's not just about the medical science; it's about understanding their needs and concerns." (P.3)

II) Lack of ongoing training and professional development opportunities

Many EMTs identified a lack of ongoing training and professional development opportunities as a major barrier to integrating medical science education in prehospital emergency care. They desired access to continuing education programs, regular feedback and evaluation, and opportunities to learn from and collaborate with other healthcare professionals.

A) Lack of access to continuing education programs: Participants reported that they did not have access to continuing education programs to help them improve their skills and knowledge. They felt that this lack of access hindered their ability to provide high-quality care to patients. P8 stated: "We don't have access to any continuing education programs. We're stuck with the same level of knowledge we had when we graduated."

B) Lack of regular feedback and evaluation: Participants felt they did not receive enough feedback and evaluation on their performance. They noted regular feedback and evaluation are important for improving their skills and knowledge. "We don't get any feedback on our performance. We need to know where we're falling short so we can improve." (P.10)

C) Limited opportunities to learn from and collaborate with other healthcare professionals: Participants reported having limited opportunities to

learn from and collaborate with other healthcare professionals. They felt that this lack of collaboration prevented them from expanding their knowledge and improving their skills. "We don't get to work with other healthcare professionals often. It would be great if we could learn from them and collaborate to provide better care for our patients." (P.7)

Discussion

The results of this study provide valuable insights into the perspectives of EMTs on integrating medical science education in prehospital emergency care in Iran. The findings suggest several challenges and barriers to integrating medical science education in EMT training programs in Iran, including inadequate training, a lack of ongoing training and professional development opportunities, and a need for greater collaboration between stakeholders.

In this study Participants reported inadequate training in terms of hands-on experience, exposure to diverse patient populations, and communication skills and cultural competence. These findings are consistent with previous research in this area. In a study by AL Mutairi et al., emergency medical services (EMS) providers in Saudi Arabia also reported a lack of hands-on experience and inadequate exposure to diverse patient populations (19). Similarly, a study found that EMS providers in India lacked training in communication skills and cultural competence (20). The findings of our study and these previous studies suggest a need for improvement in the medical science education of emergency medical technicians better to prepare them for their roles in the field.

The present study also found that EMTs in Iran face challenges regarding ongoing training and professional development opportunities. Participants reported a lack of access to continuing education programs, limited feedback and evaluation, and limited opportunities to learn from and collaborate with other healthcare professionals. These findings are consistent with previous research. For example, some studies found that EMTs in Oman lacked access to continuing education programs (20-22). Some studies found that EMTs lacked opportunities for collaboration with other healthcare professionals (23-25). These findings suggest a need for improvement in the ongoing training and professional development opportunities for emergency medical technicians in Iran and other countries.

The findings of this study emphasize the importance of collaboration in developing and implementing EMT

training programs. Participants highlighted the need for input from emergency medical technicians and ongoing stakeholder communication and feedback. Collaboration is crucial for the development and implementation of effective EMT training programs. A study found that collaboration between healthcare providers, educators, and policymakers was necessary to develop comprehensive EMT training programs (26). The study found that collaboration helped to ensure that EMTs received training that was relevant, up-to-date, and tailored to the needs of their communities. Collaboration also allowed for identifying gaps in EMT training and developing strategies to address those gaps.

Another study emphasized the importance of collaboration in implementing EMT training programs (27). The study found that collaboration between EMTs and their communities was necessary to ensure that training programs were culturally sensitive and effective. Collaboration also helped to identify barriers to effective EMT training, such as language barriers or lack of access to training resources. By working together, stakeholders were able to develop strategies to overcome these barriers and ensure that all EMTs received the training they needed to perform their duties effectively.

The present study's finding that EMTs in Iran recognize the potential impact of integrating medical science education on patient outcomes is consistent with previous research. Some studies showed that EMTs who received additional medical education had better patient outcomes than those who did not (28, 29). Similarly, some studies found that EMTs who received additional advanced airway management training had higher intubation success rates and better patient outcomes overall (30, 31). Recognizing the potential impact of medical science education on patient outcomes highlights the need for ongoing professional development for EMTs. As medical science continues to evolve, EMTs must receive ongoing training to stay up-to-date with the latest advances in medical science and technology. This ongoing training can help ensure that EMTs provide the best possible care to their patients and are equipped to handle the unique challenges they may face in their communities. By investing in ongoing professional development for EMTs, healthcare systems can improve patient outcomes and ensure that their emergency medical response systems are as effective as possible.

Overall, the findings of this study suggest that there is a need for ongoing collaboration and communication between stakeholders and ongoing training and

professional development opportunities for EMTs in Iran. The integration of medical science education in EMT training programs has the potential to improve the quality of prehospital emergency care and, ultimately, the health outcomes of patients. Future research is needed further to explore the perspectives of EMTs and other stakeholders and to develop effective strategies for integrating medical science education in EMT training programs in Iran.

Conclusion

The integration of medical science education into EMT training programs has the potential to address the challenges faced in prehospital emergency care and enhance patient outcomes. This study identified significant challenges related to the current state of EMT training programs in Iran, including inadequate hands-on experience, limited exposure to diverse patient populations, and insufficient communication skills and cultural competence training. Additionally, a lack of ongoing training and professional development opportunities, as well as limited collaboration between stakeholders, were found to hinder the integration process. To overcome these challenges, it is crucial to implement effective strategies that improve EMT training programs in Iran. These strategies should focus on increasing hands-on experience to enhance practical skills, incorporating comprehensive communication and cultural competence training, and providing continuous training and professional development opportunities. Moreover, fostering collaboration and communication among stakeholders is essential for successfully developing and implementing integrated EMT training programs. Addressing these challenges and implementing the suggested strategies can improve the quality of prehospital emergency care in Iran and similar contexts. The findings of this study provide valuable insights that can guide policymakers, educators, and healthcare professionals in designing and implementing effective interventions to enhance prehospital emergency care and ultimately improve patient outcomes.

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Students as Propulsion Engine of Medical Education System: The Concept of the Student Committee of Medical Education Development

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Keywords: Medical Education, Student Support System, Extra-Curricular Activities, Curriculum

Dear Editor,

From the past decades to the present, medical education has been known as one of the most important fields of education which trains those who can, directly and indirectly, affect human health and lives (1). Despite medical education being divided into various sectors, its ultimate aim is to “supply society with knowledgeable, skilled, and up-to-date health profession providers who put patient care above self-interest, and who undertake to maintain and develop their expertise over the course of a lifelong career”. Therefore, medical education is

imagined as a busy, clamorous place, where a host of pedagogical practices, educational philosophies, and conceptual frameworks collide (2). As students are known as one of the main targets of the medical education system, it seems that they can potentially act as a propulsion engine for the medical education system (3); therefore, in the present article, we are going to present the concept of the *student committee of medical education development (SCMED)*.

Having a detailed view of the medical students' activities indicates that they spend their time in various

curricular and extracurricular activities. Medical students' extracurricular activities are not limited to educational activities; they can go further to include a wide range of activities such as research, innovation, and social activity (4). Interestingly, in 2017, a student committee was formed in the Iranian Universities of Medical Sciences called *SCMED*.

To express the concept of the *SCMED*, it is important to note that the main aims of the committee were to have beneficial impacts on the medical education system, improve the outcomes of the medical schools, educate multidimensional students, and highlight the role of the students in not only during their educational period but also after their graduation. To maintain the goals of the *SCMED*, a four-level structure was constructed, from the universities to the Ministry of Health and Medical Education. Additionally, each level of the committee could encompass four main sub-committees, including education, research and innovation, evaluation, and public relations. In detail, the four-level structure of the *SCMED* consists of the graduate students committee, as the experience-transferring arm, the central committee which includes eleven students that are directly supervised by the Ministry of Health and Medical Education, the regional network which consists of several universities within a specific educational region, and the local committee in each university. In fact, from the top of the network to the bottom, the roles change from policy-making to implementing the policies. According to the structure of the *SCMED*, specific duties are defined for each level and sub-committees. In detail, the education sub-committee is going to design, implement, and evaluate a comprehensive operating model for empowering students in the field of medical education. The research and innovation sub-committee is going to plan and support the implementation of medical education research projects and innovations in response to the up-to-date needs of the medical education system- in fact, this sub-committee makes the activities evidence-based. The evaluation sub-committee is going to supervise the activities and provide feedback and suggestions to resolve the obstacles. Finally, the public relations sub-committee is not only going to facilitate coordination between different sub-committees and other structural levels but also going to be a bridge for medical students to the higher levels of the medical education administration.

Some similar organizations and committees were developed in the world before the *SCMED*; however, none of them have the properties of the *SCMED*,

especially being the unique student committee supported by the government which is directly linked to the Ministry of Health and Medical Education. During the past six years, the *SCMED* presented its effects, such as students' involvement in educational decisions, making students interested in medical education, making the quality of medical education more critical to the students and sensitizing them, making students attracted to the educational research, on the Iranian medical education system as the student committee, there are still some concerns and gaps about such activities; like lack of support, students' interests, and some pitfalls of the *SCMED* power on the changes on the medical education system and its curriculum. Additionally, among the most highlighted concerns, there is a fundamental question of whether medical students' involvement in such committees and activities is known as the educational goals. Moreover, some previous studies have not presented beneficial impacts of students' activities on the educational system; even, they called them time-wasting activities for medical students; but there is strong evidence against these opinions (5). Overall, it can be stated that the *SCMED* concept had brilliant impacts during its birth; however, there is still a long way to this student network in the medical educational system.

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Vertical Integration in Visual System Education: A New Educational Experience

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Abstract

Background: The purpose of the medical curriculum is to train up-to-date physician who can safely and effectively diagnose diseases and increase the health of society.

Objectives: We designed a visual system anatomy educational course to investigate the effect of the “extending the teaching of the basic science throughout the curriculum” strategy, on the level of satisfaction and learning of medical student’s anatomy knowledge.

Methods: This study was an interventional, in descriptive type, done in visual system anatomy educational course and designed in four training sessions consisted of: 1. A 15 multiple choice questions pre-course online test, distributing lesson plans and related educational videos, 2 and 3. training sessions in which education content by using cadaver and other teaching aids such as moulage and slides were presented; 4. Discussion, post-test holding and distribution of satisfaction questionnaire. The overall pre-intervention and post-intervention data were analyzed using Kolmogorov–Smirnov test and paired t-test in Statistical Package for the Social Sciences (SPSS) software. P-value less than 0.05 was considered as statistical significance.

Results: Based on the results of the final exam, correct answer percentage to each question (CAP) of post-intervention were higher than the CAP of the pre-intervention. The statistical analysis also indicated that there was significant difference in the mean of CAPs between the two tests ($p < 0.01$).

Conclusion: It seems that proposing a new curriculum and including basic anatomy sessions in clinical training courses can help students to review basic science concepts and apply them in developing clinical skills and ultimately safe patient care.

Keywords: Curriculum; Integration, Training Programs, Questionnaire

Background

The basis of the medical school curriculum is to train competent physicians who are able to manage a variety of cases - from simple to complex - safely and effectively. However, this seemingly simple goal, sufficient coordination between theoretical and clinical courses (1) requires combining a wide range of information and skills into a complex balance, and collective agreement to achieve this has yet to be reached. There are several medical curriculum models that have been used over the years and in some form still form the basis of medical education today. These include the apprenticeship model (2), the discipline based model (3), outcome based model (4), e-portfolio model (5), and hybrid spiral model (6). In all the above educational models, what is

important is the training of doctors who can benefit from the basic medical sciences in the face of patients and act efficiently in the diagnosis and treatment of diseases. The wide range of medical curricula in medical schools around the world reflects this lack of consensus (7).

The problems of separate pre-clinical and clinical curriculum have led scientists to open a new space called “integration in medical education” in the past decades (8). As the Brauer and Ferguson mentioned at the AMEE guide “horizontal integration is defined as integration across disciplines but within a finite period of time”, whereas “vertical integration represents integration across time” (9). Different studies suggest teaching strategies like restructuring the curriculum into

cross-cutting themes (10), incorporating clinical experiences into the teaching of the basic sciences (11, 12), extending the teaching of the basic science throughout the curriculum (13, 14) and etc. to incorporate vertical integration into medical curriculum. According to the studies in this field, the main goals of the integration program in medical education are significant improvement of learning and visualization of educational innovations in medicine, scientific orientation and study reform of students involved in medical fields (15). Structural goals include integrating theoretical and clinical teaching content and incorporating it as a core curriculum of broad studies as well as a higher degree of self-directed teaching and learning. Counseling services and actions performed by qualified and trained faculty, along with other quality assurance measures, form an important foundation for an integrated educational program (14, 16). Although the integration of basic science and clinical concepts into the curriculum of medical students helps them develop clinical reasoning skills (17), curriculum reform based on the vertical integration approach presents many challenges and cost to faculties and students. However, there are still no detailed studies to provide a framework or practical guidance on which of the teaching strategy is more efficient and how to plan and implement integration in a medical education curriculum (18). As it is important to continually return to basic science during clinical education and helps students connect the clinical information they learn from patient histories, physical examinations, and laboratory studies to biological principles and mechanisms and generally learn deeply (19), we designed a visual system anatomy educational course to investigate the effect of the “extending the teaching of the basic science throughout the curriculum” strategy which was mentioned above, on the level of satisfaction, learning and retention of anatomy of general medicine students at Alborz University of Medical Sciences in 2020.

Objectives

We designed a visual system anatomy educational course to investigate the effect of the “extending the teaching of the basic science throughout the curriculum” strategy, on the level of satisfaction and learning of medical student’s anatomy knowledge.

Methods

This Interventional-descriptive study was conducted during the academic year 2020-2021 among available

145 fourth-year medical students on the first two days of their ophthalmology rotation at the Madani hospital, Karaj, Iran.

The study was approved by the Human Research Ethics Committee of the Alborz University of Medical Sciences (IR.ABZUMS.REC.1399.280). All participants provided online consent, and were assured of the voluntary nature of participation before providing consent.

The visual system anatomy educational course was designed in four training sessions which were held on online platforms due to restrictions of the Covid-19 pandemic.

The first session consisted of conducting a pre-course online test, distributing lesson plans and educational videos related to the vertical integration curriculum.

The online examination consisted of 15 multiple choice questions that assessed students’ knowledge of visual system histology and embryology, orbit, eyelid, eyeball, extrinsic eye muscles, eye vessels and nerves anatomy. The book used as a source for designing the questions was Snell's Clinical Anatomy by Regions. After the exam, the instructor checked the exams and let the students get to know their weak points. The second and third sessions were the training sessions in which the faculty professor of anatomy taught education content by using cadaver and other teaching aids such as moulage and slides. In the fourth session one of the students was asked to teach the education content of the previous sessions using cadaver and moulage. The students had to take a second online exam, which had same questions as the first exam. Also, the questionnaire on students' satisfaction with the holding and the necessity of implementing the educational package with a vertical integration approach was provided for them to fill out. This questionnaire included descriptive questions about the current state of vision course students’ awareness and 6 yes-or-no questions (6 points).

The overall pre-intervention and post-intervention data were analyzed using the Kolmogorov-Smirnov test to determine the normality of the data ($p=0.20$), and then a paired t-test was used to compare the mean scores of the groups in the Statistical Package for the Social Sciences (SPSS) software. A P-value less than 0.05 was considered statistically significant.

Results

Pre and posttest: Based on the results of the final exam, the correct answer percentage to each question (CAP) of the post-intervention test was higher than the

CAP of the pre-intervention test. Simultaneously, the mean of the CAPs was higher in the post-intervention test than in the pre-intervention test ($p < 0.01$) (Table 1, Figures 1 and 2).

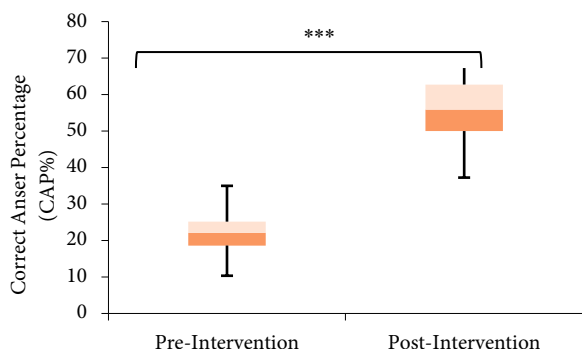


Figure 1. Pre- and post-intervention CAP (**P-value < 0.01)

For all questions, the number of correct answers was higher after the course. The detail for each question is reported in Figure 2.

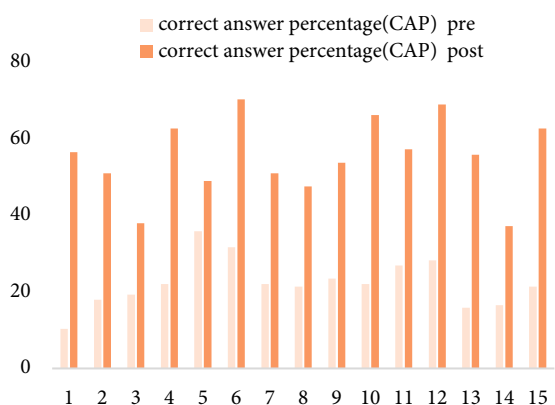


Figure 2. CAP before and after the courses for each question

Questionnaire: Approximately, 85% of the students declared that their anatomy knowledge from the basic science courses was not sufficient to use in the clinical course. They assessed limited faculty involvement, inadequate facilities like cadavers or moulage, absence of a person as a director of the laboratory as the main obstacles to incorporating basic science courses into the clinical curriculum. The other factors were insufficient space at hospitals and time restrictions.

80% of the students believed that anatomy should be integrated into internships' medical curriculum and most of them agreed that the impact of this vertical integration on their learning and retention would be greater through simulation or laboratory dissection like cadaver and moulage.

Discussion

In the present study, a one-month basic science training course was held at the beginning of the ophthalmology department for clinical course students, and the level of knowledge and awareness of the students was measured by taking pre- and post-course tests.

Also, using a standard questionnaire, the level of satisfaction and need of students to hold these courses during the clinical courses was measured. The comparison of the pre-test and post-test results showed that the students obtained better grades after the training course, which indicated the improvement of their awareness and understanding of the topics related to the anatomy of the visual system and the necessity of planning for such courses, basic sciences in clinical courses. In addition, based on the feedback of the majority of students, in response to the needs and satisfaction questionnaire, they responded positively to the approach of integrating basic anatomy while taking clinical courses and found this course useful and helpful for better performance as a doctor.

As we enter the new era of medicine, there is a continued emphasis on the need for integrated learning in health professions education and clinical education. Educational managers want to train thoughtful employees in the future. In other words, future doctors must be skilled and reliable in interacting, applying and transferring basic knowledge during clinical care of patients. Indeed, progress in lifestyle and personalized medicine in the 21st century depends on health care practitioners being able to bridge and combine basic and clinical science in a way that is personally meaningful and professionally useful (20). Despite imprecise and inconsistent definitions of terms related to integration in medical education, many studies involving vertical integration of basic medical sciences in a clinical setting have also received positive responses from students, with learners preferring vertical integration courses to basic science education or clinical hospital education, separately (21-23).

Overall, a substantial body of data and educational theoretical foundations support greater integration of the basic and clinical sciences in the medical curriculum, and feedback from students and instructors suggests that an integrated curriculum can be well suited to the effective practice of medicine and its positive results are at least not less successful than the traditional curriculums (7).

Table 1. The correct answer percentage of questions in pre- and post-intervention tests of the educational package of the visual system

Group	Correct answer percentage (CAP)			
	Mean	SE of mean	Maximum	Minimum
Pre-intervention	22.39%	1.66	35.86	10.34
Post-intervention	55.22%	2.60	70.34	37.24

The mean scores of students in post-test are higher than pre-test (p-value<0.01)

According to Garcia (24), “medical education is the process for training doctors, subordinate to the dominant economic and social structures in societies in which It takes place”. Regarding to mentioned critical point, there are some categorized reasons for integration: 1. Standardizing learning outcomes and training doctors with high general competency indicators and providing options for customizing the learning process, providing opportunities to use experiences in research, policy making, education, etc., which reflects the broad role of doctors (24); 2. Medical schools should train graduates so that they can integrate all aspects of knowledge, skills, innovation, research and professionalism to provide medical services and improve the health of society, therefore, medical schools and teaching hospitals should support innovative educational systems (25); 3. The development and actions of professionalism should be the backbone of medical education (26).

The vertical integration of basic science knowledge and clinical education in parallel deepens the understanding of basic science in the field of clinical problem understanding and makes learning more comprehensive and meaningful by stimulating intellectual curiosity (27). Applying the reform method by trained professors, in addition to increasing students' motivation and pushing them towards self-learning, can even lead to the establishment and management of integrated educational hospitals (3, 28).

Integrative learning in the health professions essentially involves the ability to link concepts from different but related fields, engage in higher-order thinking, and apply them in response to clinical problems that affect patient care. The lack of published educational articles in the field of integration shows the lack of consensus in reviewing traditional educational curricula or the lack of publication of educational experiences in this important matter. This causes the loss of opportunities for the best educational practice based on international standards.

Considering all above, our goal is a truly needs-based, differentiated learning experience in a lower-

middle-income country and the results of our pilot study were satisfactorily in line with this goal.

We hope that health professions educators and integrated curriculum developers will benefit from our study and draw attention to recent international definitions of integrated learning, teaching, curriculum and teaching.

Conclusion

Consequently, incorporating relevant and more recent anatomy sessions into clinical education can help students review basic science concepts and apply them to clinical practice that result in knowledge gain and improvement of summative scores. This allows for the development of clinical skills and ultimately safe patient care. By proposing a new curriculum, it seems possible to train physicians who may lead changes in the health care system and have a positive impact on the well-being of the individuals and communities in which they work.

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Medical Students' Reflection on Early Clinical Exposure Experience: A Qualitative Research

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Abstract

Background: Early clinical exposure to medical curricula can help students understand the social context of medicine and facilitate their transition to the clinical environment.

Objectives: The present study was designed and implemented to investigate medical students' experiences in this regard.

Methods: In this qualitative research, 2nd-semester medical students underwent reflection and were asked to respond to open-ended questions in written form after their initial clinical exposure in teaching hospitals. The written responses provided by the students were analyzed using open coding to extract initial codes, subcategories, categories, and themes.

Results: The responses of 52 participating students were coded, resulting in the extraction and formation of 252 initial codes, 9 subcategories, 5 categories, and 2 themes.

Conclusion: Reflection through early clinical exposure can induce motivation to lay the foundation for developing core competencies, including communication skills, problem-solving, clinical reasoning abilities, personal development, and cultivation of professional identity and professionalism among medical students.

Keywords: Reflection; Medical Student; Early Clinical Exposure; Qualitative Research

Background

During the last decades, the education system, as a social institution, has undergone significant changes and transformations alongside other institutions, with notable reforms being implemented. Among the most crucial changes are the emphasis on the accountability of higher education and the adoption of competency and competency-based education in medicine, with Harden's introduction being recognized as the most influential development in the last decade (1). The implementation of competency-based education requires the incorporation of core competencies into educational planning as longitudinal themes, starting from the entrance to medical school and continuing through appropriate strategies and methods. As a result, early clinical exposure for medical students becomes crucial in creating suitable opportunities for developing the expected competencies. It is believed that reflection can be effective in this process (2). Dornan and Bundy

(2004) reported in their study that early clinical exposure may shift medical curricula toward the social context of medicine, facilitating the smooth transition of medical students into the clinical environment. This exposure can also serve as a source of motivation, making students more confident and fostering self-awareness and other-awareness. Additionally, it has the potential to strengthen and deepen their theoretical knowledge contextually, enhancing their understanding of behavioral and social sciences, the healthcare system, and the roles of healthcare professionals (3). Reflection is an indispensable and essential component of health professions education. It is a controllable process, and various educational interventions, such as guided reflection, can enhance it. Through reflection, rote learning is eliminated, paving the way for deep and meaningful learning (4).

One of the challenges of clinical training is the absence of a clear connection between basic science

courses and clinical practice. To bridge this gap, junior students require more exposure to the clinical environment and opportunities to observe the practical application of knowledge. Therefore, early clinical exposure and the presence of medical students in hospitals during the initial years are vital components of medical education (5, 6). Medical core competencies develop gradually during early clinical exposure and subsequent exposures in clinical training (2). Reflection can occur before, during, or after learning, leading to meaningful learning experiences. Notably, medical students may not fully comprehend the importance of learning basic sciences before entering the clinical environment. Early clinical exposure offers an appropriate platform for reflection, fostering meaningful learning and skill acquisition by combining theoretical knowledge with clinical experience. This approach enables students to identify and become familiar with the essential competencies required in future clinical situations (7). Studies have demonstrated that early clinical exposure and engagement in the real clinical environment can enhance active learning, increase learner participation, and foster student empathy (8). Various assessment tools, such as self-report questionnaires, written statements, and student learning logs, have been used to evaluate students during medical education courses (9).

As expected, medical students need to be able to identify and comprehend the professional behaviors of themselves and others. To promote critical thinking about these issues, we encouraged them to engage in guided reflection on the actions of healthcare professionals at work, their dress code, the professional context, and various observed interactions during early clinical exposure by responding to purposeful questions in this regard (10). Although reflection is a well-known process, our knowledge is little about its application in early clinical exposure and its role in developing professional identity and professionalism in this setting.

Objectives

The present study aimed to explore medical students' perceptions and the educational impact of guided reflection in the context of their first exposure to the clinical environment and social care experiences.

Methods

Study Design: This qualitative research utilized thematic content analysis conducted through guided reflective narrative writing following an early clinical exposure course.

Participants: All first-year medical students at Islamic Azad University of Medical Sciences participated in the first early clinical exposure in 2023.

Tools and Data Collection: In this university, the early clinical exposure program was initiated in the 2nd semester and lasted three days. During this program, students were classified into ten groups and accompanied by a trained mentor in teaching hospitals affiliated with the university. Guided reflection was designed in the form of five purposeful open-ended questions to gather insights into the medical students' perceptions and feelings regarding their first professional attendance in the hospital, dress code, observations of health professionals' work, cultural and social aspects in the clinical environment, professional communication in the hospital, and critical thinking about both themselves and others. Students wrote reflective narratives after providing informed consent. They were required to prepare their writings and return them after three days.

Data Analysis: The received written responses were carefully reviewed, and coding was performed simultaneously. Whenever there was ambiguity, or more explanation was needed, it was discussed with the student in-person. Moreover, the comments expressed by students and the mentor's observations in different groups were recorded as field notes and added to the written responses. First, the responses were divided into semantic units, and then, open coding was conducted. Afterward, different codes were compared based on their differences and similarities and classified into subcategories and categories. This iterative process of refining categories continued, taking into account each category's unique characteristics. During this stage of the coding process, the formation of categories and subcategories required considerable time and effort from the researchers to ensure the content accuracy. The findings were thoroughly discussed and reviewed multiple times by the researchers to enhance the study's rigor. The researchers tried to consider the trustworthiness criteria; therefore, ample time was dedicated to collecting and analyzing data concurrently, establishing good communication with the participants, and obtaining approval of their manuscripts. The researchers ensured a detailed description and sought feedback from other colleagues by re-reading the extracted codes to enhance accuracy. The conclusion and summary were reached with unanimous agreement among the researchers. Furthermore, to enhance the study's validity, an external expert (A.F.) in qualitative

research reviewed and confirmed the findings. (A.F. has a Ph.D. in medical education is experienced as a director of EDC, is the students' favorite professor and students have a good and friendly relationship with her, has enough experience in qualitative research, and has published several papers.) The early clinical exposure course is also supplementary and has no grade. Two authors were senior medical students who collaborated in implementing the course and data collection and analysis.

Similar to other qualitative research, this study is not devoid of potential errors, as the researcher's mentalities, thoughts, and opinions may inadvertently influence the research topic and data collection process. To resolve this problem, we made a concerted effort to practice researcher bracketing during data collection and analysis to ensure an unbiased approach. Additionally, we assured all participants that their responses would be treated with utmost confidentiality by the researcher, aiming to minimize potential biases in respondents' responses.

Results

A total of 52 students (29 women and 23 men; mean age = 21.8 ± 0.8) participated in this study. Two reports were excluded from the study due to incompleteness. The findings of this research resulted in the extraction and formation of 252 initial codes, 9 subcategories, 5 categories, and 2 themes. The extracted initial codes, subcategories, categories, and themes are presented in Table 1.

Discussion

In this study, 252 initial codes, 9 subcategories, 5 categories, and 2 themes were identified. The 5 main categories include: "Experiencing positive and motivating feelings," "development of medical professional identity," "fostering the competency of reflection and improvement," "fostering the competency of communication skills," and "fostering the competency of clinical reasoning ability and problem-solving." The 2 themes obtained are "guiding and accelerating the development of professional identity and medical professionalism" and "creating the basis for the establishment of core medical competencies."

Category of "Experiencing Positive and Motivating Feelings"

In general, this experience satisfied and motivated the students. Similar to findings of other studies, such as Lislot et al.'s qualitative research (2007) on medical students, the participants expressed their enjoyment of

clinical training and acknowledged the immense value of these experiences for their learning (11, 12). The students' reflections highlighted that early clinical experiences offer valuable opportunities to learn professional practices encompassing mind, action, and attitude (13, 14).

Category of "Development of Medical Professional Identity"

Early clinical exposure and presence in the clinical environment play a crucial role in the development of students' professional identity (15). Additionally, students' perception of the environment and adherence to essential principles, such as compliance with dress code, further strengthen this process. Stark has found that guided reflection is a valuable method for exploring professionalism in a real workplace, providing a rich learning experience (16, 17). A qualitative study conducted in Canada in 5 fields of medicine, dentistry, pharmacy, nursing, and physiotherapy also indicated that students had a limited understanding of their professional roles and mainly focused on the development of a unidimensional identity. Early clinical exposure, observation of professional role models, and exposure to teamwork are critical to developing collaborative practice and promoting the development of interprofessional identity. Therefore, interprofessional socialization and interprofessional identity should be considered in early exposure periods (3, 18).

Category of "Fostering the Competency of Critical Thinking and Improvement"

Reflection is a metacognitive skill that empowers learners to enhance their understanding of past, present, and future experiences. Through experiential learning, reflection aids students in improving their future learning processes.

The practice of reflection, incorporating self-awareness, self-monitoring, and self-regulation, leads to professional growth and improvement (9). In this study, all students mentioned their strengths and weaknesses through guided reflection. Analysis of the students' statements revealed that they expressed weaknesses in various areas, including communication with patients, experiencing stress, lack of self-confidence, deficiencies in basic knowledge and information, physical problems, and deficiencies in practical skills. Similar to many reports, including Sarikaya's study (2014), students in this research also experienced some stress during their first clinical encounter with patients (3, 9).

Of course, the students highlighted their strengths as well. In addition to identifying their strengths and weaknesses, the students mentioned strategies for improvement and development in their statements. For example, one student stated, "Since we are currently in the basic medical sciences stage and have limited exposure to bedside care, this experience allowed us to gain a better understanding of the courses by being in the hospital and interacting with internship students. It provided us with a broader perspective." Two students reported negative experiences, warranting early attention and advice to address any potential challenges the students may face during their clinical training.

Category of "Fostering the Competency of Communication Skills"

The presence of students in the clinical environment and their observations of interactions that took place in the hospital highlighted the importance of communicating with colleagues and patients and empathy in medical practice. A qualitative study conducted at the Mayo Clinic also revealed that early clinical experiences with hospitalized patients offered crucial opportunities for students' professional development. While some students experienced slight stress before each patient encounter session, they generally expressed enjoyment in the duties and roles of medicine. They expressed their fondness for interacting with patients in the hospital, engaging in effective communication, taking patient histories, conducting physical examinations, formulating differential diagnoses, and sharing knowledge (11).

Category of "Fostering the Competency of Clinical Reasoning Ability and Problem-Solving"

The students evidently understood the importance of clinical reasoning and problem-solving, and the significance of paying attention to the history, symptoms, and signs of the disease. They also articulated their observations in their essays. Numerous studies have also highlighted how students come to realize the importance of medical history and its findings in the diagnosis and treatment process during early clinical exposure (3).

Goto et al. (2009) also achieved results similar to our findings in a report on implementing the course in Japan. Students regarded communication skills, responsibility, professionalism, and sufficient motivation as essential items of the medical profession. Students evaluated this course as very valuable (19). In a cross-sectional survey in Oman, Tariq studied the experience of Internet students with early childhood

education (ECE). The students read this course as an important part of the pre-clinical curriculum; A significant relationship between ECE and theoretical knowledge, a sense of responsibility as a future doctor, and future career choice was also reported (20). In a study report entitled "Introducing Reflective Narrative for First-Year Medical Students to Promote Empathy as an Integral Part of Physiology Curriculum," Savitha concluded that guided reflection facilitated empathic behavior in medical students and the realities, and they understand the medical profession better (10). In a focus group study conducted by Aduli consisting of 12 participating medical students, the students were worried about the heavy workload and knowledge gap and felt inadequate and empowered. Reporting these shortcomings and challenges requires the support of senior students and mentors to overcome stress and worry. Also, course supervisors should strengthen lifelong learning and reflection (13, 21). The findings of various studies in different educational settings are in line with the findings of the present study; therefore, early clinical exposure can be used as a useful medical course enriched with targeted planning.

One of the limitations of this study was the inclusion of only one group of medical students admitted, and it was conducted in the form of a written narrative. It is suggested that future studies be conducted with more groups of students using face-to-face interview methods. Also, longitudinal and comparative studies can examine the consequences of this course at the clinical stage.

Conclusion

Reflection through early clinical exposure can induce motivation to lay the foundation for developing core competencies in medical students, including communication skills, problem-solving, clinical reasoning, personal development, and the establishment of professional identity and professionalism.

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Conflict of interests: There is no conflict of interest.

Ethical approval: In this study, all satisfied students voluntarily participated. Adequate explanations were provided to the students regarding the optional nature of their participation, the confidentiality of their information, and the anonymous use of data. Furthermore, this study obtained ethical approval (IR.IAU.MSHD.REC.1401.181)

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Table 1. Initial codes, subcategories, categories, and themes

Theme	Category	Subcategories	Initial codes	Semantic unit samples (Participant ID)	
Guiding and accelerating the development of professional identity and medical professionalism	Experiencing Positive and motivating feelings	Positive and motivating feelings	Good, positive, and satisfying feeling of being in the hospital	<p>“It was the first time I was in the hospital as a medical student. Despite not having slept for several days due to an exam that day and feeling hungry, I did not feel bored because I loved that environment, and it fascinated me every moment. I was eager to continue and explore the rest of the hospital.” (28)</p> <p>“It was a very exciting and interesting experience, giving me a better and deeper understanding of the field I chose.” (23)</p>	
				<p>“The type of dressing in the hospital is essential for a doctor. This opportunity allows us to apply what we have been taught in the university about how to dress, making us more organized and comfortable and promoting harmony among everyone.” (12)</p> <p>“Wearing a professional dress makes me feel comfortable as a student or doctor and allows me to focus on my work. It also gives the patient a sense of trust.” (41)</p> <p>“The hospital environment fosters unconscious professional behavior among doctors and staff. For example, I observed sincere relationships with patients and respectful interactions among the staff, reflecting a culture of professionalism.” (12)</p> <p>“The conditions in the hospital are different from the university, requiring a more professional approach. Despite the differences, the experience was pleasant and more disciplined.” (42)</p>	
	Development of medical professional identity	The role of environment in creating professional identity	Affected by the professional and legal environment of the hospital	Understanding the doctor's responsibility toward the patient	<p>“It was a good experience; it made us learn new things, and feeling responsible for the patient was interesting.” (37)</p> <p>“Talking with the patient and her comments about the experience and the course of the disease made me realize our responsibility in the future.” (16)</p>
					<p>“Talking with the patient and her comments about the experience and the course of the disease made me realize our responsibility in the future.” (16)</p> <p>“It was a beneficial experience and made me seriously think about the future and presence in the hospital environment.” (20)</p> <p>“I had not understood the heavy responsibilities of a patient's life for a doctor until then.” (18)</p> <p>“The importance of responsibility is more than I can imagine in this job.” (3)</p>
			Valuing dress code	Valuing and compliance with professional dress code	<p>“Dress code had a sense of pride along with responsibility.” (16)</p> <p>“It should be said about the dress code that the things mentioned in it make us more comfortable, and it may induce the feeling of being a typical doctor.” (33)</p>
					<p>“Facing the future path so that I can acquire the necessary skills to enter this path as soon as possible.” (2)</p> <p>“Yes, very much... and my motivation to study basic science lessons increased.” (3)</p>
Creating the basis for the establishment of core medical competencies	Fostering the competency of critical thinking and improvement	Planning for personal development	Increasing motivation for progress and effectiveness	<p>“Through this experience, I realized my weaknesses. I had not studied the lessons taught in the university in enough detail, and I paid more attention to generalities. Now, I</p>	
				<p>Increasing the sense of responsibility for the</p>	

			improvement of their knowledge and skills	<p>understand how these details are crucial in diagnosing diseases accurately. If we do not learn the subjects correctly and thoroughly at the university, we cannot provide proper care to patients as good doctors in the hospital, and the likelihood of error in disease diagnosis increases." (20)</p> <p>"Honestly, from a knowledge standpoint, I feel that I should study more than others, and I have a serious plan to improve my studying from the references." (22)</p>
Creating the basis for the establishment of core medical competencies		Identifying individual weaknesses	Feeling weak in initial communication with patients	<p>"Communicating with the patient for the first time was a little difficult for me, but I think the problem will be solved by getting more experience." (2)</p> <p>"My weaknesses were being shy and stressed due to doubting the correctness of what I was doing and not being used to the hospital environment as a medical staff." (36)</p>
			Experiencing stress and lack of self-confidence	<p>"When we were supposed to ask questions and take a history at the patient's bedside, I was very stressed and did not know how to communicate with the patient and ask him questions. I hope this problem and my lack of self-confidence will be resolved in the future." (36)</p>
			Identifying a lack of knowledge and basic information	<p>"My weakness, which I came to in this experience of being in the hospital, was that I did not study the lessons taught in the university in detail, and I paid more attention to the generalities, and now I understand how effective these details are in the correct diagnosis of the disease and if we do not learn them correctly and well in the university, in the hospital, we cannot take care of the patients as a good doctor, and the possibility of error in the diagnosis of the disease increases." (52)</p>
			Identifying physical problems	<p>"My problem was premature fatigue, and I was unable to stand for more than half an hour." (21)</p>
			Identifying practical skill problems	<p>"Skills such as taking blood pressure should be strengthened by practice and repetition." (50)</p> <p>"My weakness was taking blood pressure; I did not know how to do it." (46)</p>
		Identifying positive personal traits for future roles	Ability to communicate with patients	<p>"My strength is effective communication with patients. I believe I had a good rapport with them." (2)</p>
			Identifying the appropriate personal characteristics of the medical profession in oneself	<p>"I consider my strength in this course to be clinical reasoning and to further enhance it, I need to increase my knowledge as much as possible to excel in this aspect of my work."(30)</p>
		Observing some negative issues in the clinical environment	Reporting adverse observations and experiences during the hospital stay	<p>"As soon as I enter the hospital, I sense a heavy and gloomy atmosphere. Moreover, the prevailing silence creates a feeling of fear within me." (11)</p>
			Observing non-compliance with professional rules in some cases	<p>"The hospital experience does not align well with my mood." (6)</p>

	Fostering the competency of communication skills	Communication skill with patients and colleagues	Observing respect and effective communication with patients and their companions as one of the basic principles of medicine	"I found the respectful communication with patients fascinating. Despite the doctor's busy schedule, they demonstrated patience and treated the patients with respect." (18)	
			Observing professional interpersonal relationships, mutual respect, and teamwork	"Professional relations were founded on mutual respect. It is not about someone with higher education having the right to dictate to others. The first rule for a doctor is to respect the patients, nurses, and other colleagues." (8) "One of the best aspects of the hospital was the unity and mutual respect among all the staff, including doctors and nurses. Everyone showed great respect, helped and cooperated, and strived to provide the best possible care for the patients. Everyone in the ward dedicated their best efforts to enhance the overall quality of work." (2)	
Creating the basis for the establishment of core medical competencies			Creating a sense of empathy with patients	"I was truly impressed by the observation of a patient suffering from long coronavirus disease 2019 (COVID-19), who had sought treatment from various medical facilities and was visibly struggling with the illness, resulting in weight loss." (5) "In several cases, I noticed that I was affected by the suffering and sadness of the patients, which I had not paid much attention to before. I believe I should learn clinical empathy and how to respond to such situations appropriately. Additionally, I realized the significance of communication skills and the need for more practice, particularly in communicating with patients and taking their medical history." (24) "The conversations with the patient regarding expenses and the pressures that their families bear were very impressive to me." (40)	
				Understanding the importance of clinical reasoning in medicine	"What really caught my attention was the mental pathways we had to develop for ourselves. It was like a game or puzzle where we had to find the right answer, only much more seriously!" (16)
				The challenge of history-taking and clinical reasoning	"The communication skills between basic and clinical information by creating mental engagement and simulating the clinical reasoning process should be strengthened." (15) "Discovering the patient's problem and the main cause of his/her pain is very effective." (41)
	Fostering the competency of clinical reasoning ability and problem-solving	Understanding the importance of clinical reasoning and problem-solving in medicine	Realizing the importance of paying attention to the physical and mental symptoms and signs of patients in medicine	"While studying the patient's medical records and history, we tried to explain the reasons behind each symptom and determine which disease the symptoms might indicate. Finally, we summarized the information and achieved the most probable options." (33)	

Practical Solutions for Qualitative Promotion of National and International Medical Education Events: Experiences of Participating Medical Education Specialists

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Keywords: Medical Education; Conference; Scientific Authority; Qualitative Study

Dear Editor,

Organizing national and international medical education conferences offers an invaluable forum for networking, information sharing, innovation, and transformation in the field of medicine (1), as well as for fostering social responsibility and university scientific authority (2). Therefore, it is necessary for policymakers, and organizers to ensure its continuous improvement in the future by advantaging practical solutions from stakeholders (3). In this letter, we draw on insights from a qualitative approach using the semi-structured interviews with 16 medical education specialists who participated in Iranian Conference on Health Professions Education in 2023. Participants were selected using purposive sampling method. Sampling continued until data saturation was achieved. The participants were asked about their experience of participating in event. If needed follow-up questions were asked to clarify the concept under study. The Graneheim method served as the foundation for the data analysis procedure. Through an inductive procedure, the researchers pulled codes, subcategories, and categories from part to whole such that the resulting

conceptions reflected the participant experiences (4). To ensure rigor of the data, Guba and Lincoln's trustworthiness criteria, credibility, dependability, confirmability and transferability, were followed via engagement with the data, peer check, member check and preparation of a comprehensive description of concepts, participants and methodology. Following data analysis, 232 codes were extracted and categorized into eight subcategories. Eventually, four main categories including 1.scientific authority in medical education, 2.strengths, 3.weaknesses, and 4.enhancement strategies were identified. Some of their experiences are mentioned:

"The existential philosophy of universities is to respond to society requirements, and the events presented a wide perspective in this regard by promoting educational scholarships."

"Inadequate infrastructures, impossibility of live translation, lack of using new educational approaches in presenting materials in workshops and lectures, executive inconsistencies, incorrect evaluation of programs are some problems which I cannot ignore."

Moreover, participants provided solutions for quantitative and qualitative improvement of such

national and international medical education events. These practical recommendations and suggestions for current challenges include the following:

Effective conference management is crucial for the success of medical education events. Educating and orienting the executive team can help overcome operational challenges. Utilizing conference management software can significantly benefit the planning and implementation processes. These systems provide the convenient organization of presentations and workshops, while also offering immediate updates and notifications for participants. This streamlines the implementation and guarantees effective event management. To address the lack of participation, and interaction from panel members and the audience, integrating interactive technology tools can be highly beneficial. Implementing audience response systems, such as survey software, can allow participants to engage actively, answer questions, and provide feedback in real-time, creating a more engaging and interactive environment.

In addition to technology, mentoring or coaching programs may be used to foster more guidance and engagement. Individuals have the opportunity to sign up and be matched with specialists in certain fields of knowledge according to their own interests and specific subjects. Enhancing the hardware and software capabilities of conferences is another critical aspect. Providing simultaneous translation capabilities can overcome language barriers, and create a truly inclusive environment. Using specialized software or web-based platforms that offer real-time speech-to-text or text translation can enable participants to select their preferred language, ensuring accessibility of the presented content ultimately enhancing the diverse and accessible conference globally experience.

Future events should prioritize practical, need-based presentations, combining innovative presentation methods like gamification, instructional design, and appropriate assessment techniques to enhance the quality and effectiveness of delivered content.

The integration of virtual and hybrid event formats has the potential to increase engagement and accessibility. The learning experience can be improved and active participation can be encouraged by emphasizing interactive seminars and case-based learning. Establishing cross-institutional collaborations and partnerships can facilitate the sharing of best practices and the development

of comprehensive educational programs. Furthermore, implementing continuous feedback and evaluation mechanisms can help refine the event content and format, ensuring the educational needs of the participants are consistently met.

From the perspective of scientific content, we recommend that the submissions and articles for medical education conferences be reviewed, and evaluated based on the following Ernest Boyer's four types of scholarship, including the scholarship of discovery, integration application, and teaching (5). By considering these types of scholarship reviewers can ensure that conference content is not only scientifically sound, but also highly relevant and applicable to participants' professional development needs.

In conclusion, policymakers and organizers can guarantee that national and international medical education events continue to be important venues for knowledge exchange, innovation, and professional development by putting these workable solutions into practice, which range from efficient conference management to varied presentations, and thorough content evaluation. We implore them to implement these recommendations and foster an environment that is consistently enhanced by medical education events worldwide.

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Development and Validation of Assessment Instrument for Community-Engaged Scholarship of Medical University Faculty

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Abstract

Background: In recent years, the scholarship of faculty, responding to the needs and concerns of community, has received the attention of experts.

Objectives: The present study aimed to develop and validate an assessment instrument for community-engaged scholarship of medical university faculty.

Methods: The present study was carried out in two stages. First, after searching and extensive reviewing of texts, and conducting qualitative interviews with experts, an assessment instrument for community-engaged scholarship of medical university faculty was developed and validated. In the second stage, the content analysis of mentioned instrument was performed. In order to evaluate the content validity of the instrument, ten individuals with specialized knowledge in the fields of medical education and faculty evaluation were invited to participate in a conclave. These people assessed the developed instrument in terms of content validity index, and content validity ratio.

Results: A 20-item instrument was developed to assess the community-engaged scholarship of medical university faculty. The mean CVR and CVI of all questions based on experts' opinions were 0.90 and 0.925, respectively, indicating high and acceptable validity of developed instrument. Therefore, based on the values of CVR and CVI, the content validity of all 20 initially developed questions was accepted for the final instrument.

Conclusion: 20-question questionnaire for assessing the community-engaged scholarship of the medical university faculty had a good content validity. It is recommended that this instrument be used in the regulations for the promotion of faculty.

Keywords: Community-Engaged Scholarship; Instrument; Medical University Faculty

Background

In today's world, the university is considered one of the main civil institutions, so that the growth and development of any community depends on the quality of its services (1). The principal and customary purpose of the university, which is referred to as a university of the first generation, was to provide education. The primary objective of a university of the second generation is to generate knowledge through research. One of the key missions of the third-generation university, in addition to the educational and research functions, is entrepreneurship, and creating new economic values. In the third generation (entrepreneurial) university, competition increases, and using knowledge becomes important, along with

education and research. Thus, the relationship between industry, and university is strengthened (1).

A new generation of universities, called as the fourth-generation university, has emerged (2, 3). Fourth generation universities have local and regional development policies and procedures, manage intellectual capital, and environmental changes, which are community engaged universities (4, 5). The university will serve as the hub for all national scientific, technical, and cultural advancements in the fourth generation of university students, who are excellence-oriented and whose connections to the local and global community will both function as catalysts and active participants in these changes. The central mission of the fourth-generation university is to manage future

change, and guide its immediate environment (6, 7). Modern communities face complex issues and problems that universities can be effective in solving and preventing them (8). In this regard, in recent years, attention to the roles of faculty members and their effect on local development indicators was the focus of many experts (9, 10). The community-engaged scholarship of faculty refers to the educational, research, and executive activities of faculty that respond to the needs and concerns of community. These people are those who work outside the traditional boundaries of academic environment. In other words, community-engaged scholarship includes scientific and creative activities through which knowledge is generated, and verified in reality (11, 12). This type of knowledge is generated via the partnerships with people/community, and organizations outside academic environment (13-15). Community-engaged scholarship specifically include activities that aim to answer the questions, concerns and problems of the community. Based on Metzger and Zakers (16), community-engaged scholarship generally include following characteristics:

A: These activities should be related to a community problem; B: These activities include interaction with community; C: These activities should seek answers to questions that are related to public concern; D: These activities should widen the boundaries of knowledge in a specific scientific field; E: Faculty should have a leadership role in carrying out these activities; F: These activities should lead to enhancing public knowledge and awareness; G: These activities should lead to the discovery of different aspects of knowledge, making connections between them and using them practically.

The criteria for assessing the community-engaged scholarship of faculty are in three areas of teaching, research, and executive services. The duties of faculty in teaching are more than in the past, and they are considered as people who cause the development and progress of community/organization. Research involves the generation, analysis, and implementation of information and technology in a manner that establishes a connection to the issues faced by members of the public in both academic and practical spheres. This connection facilitates the active involvement of community members in the research process. In executive services, faculty is encouraged to provide services to external communities (outside of the university), communicate with these communities, and play a leadership role in community engaged organizations (17-19).

The experience of corona epidemic showed that there are a great number of professors who can publish articles on the topic of corona in Iran, but there are very few professors who speak on the radio for people, make educational clips, facilitate the presence of non-governmental organizations, etc., since none of these measures were given a privilege in the promotion regulation. Actively affecting social and cultural environment requires more effort and collective determination. Regarding what was stated above, to develop the scholarship of medical university faculty in Iran in the area of solving health, social, economic and moral problems and increase the more concrete effectiveness of university research at the community level, the inclusion of the issue of community-engaged scholarship of faculty in the regulation of promoting faculty members will be a necessity and in line with the prestigious universities of world.

Objectives

This study was conducted with the aim of developing, and validating an assessment instrument for the community-engaged scholarship of medical university faculty in Iran.

Methods

This study was carried out based on the method suggested by Lynn (20). Searching articles using keywords, such as community-engaged scholarship; instrument; medical university faculty and related databases in English Scopus, Medline and persin, such as Embase, Iranmedex, Magiran, SID were conducted. Moreover, the study was carried out in two stages: the stage of preparation, and development of items (developmental stage), and the stage of judgment-quantification stage. In Figure 1, the stages of conducting the study were shown.

The first stage: developing data collection instrument: Developing the components of data collection instrument was done after extensive literature review of valid domestic, and foreign scientific articles in two literature reviews. The purpose of the first part of literature review was to determine the conceptual framework and areas of community-engaged scholarship of faculty (21, 22). The elements for evaluating the faculty members' community-engaged scholarship in each of the domains are taken out and placed in the second section of the literature evaluation. There were three steps done at this point. In the first step, the relevant studies in this area were reviewed, and all the characteristics of the community-engaged

scholarship of faculty were extracted. In the second step, the items for assessing the community-engaged scholarship of faculty were developed. In the third step, these items were organized, and revised in such a way that their order was logical and understandable for the respondents (20).

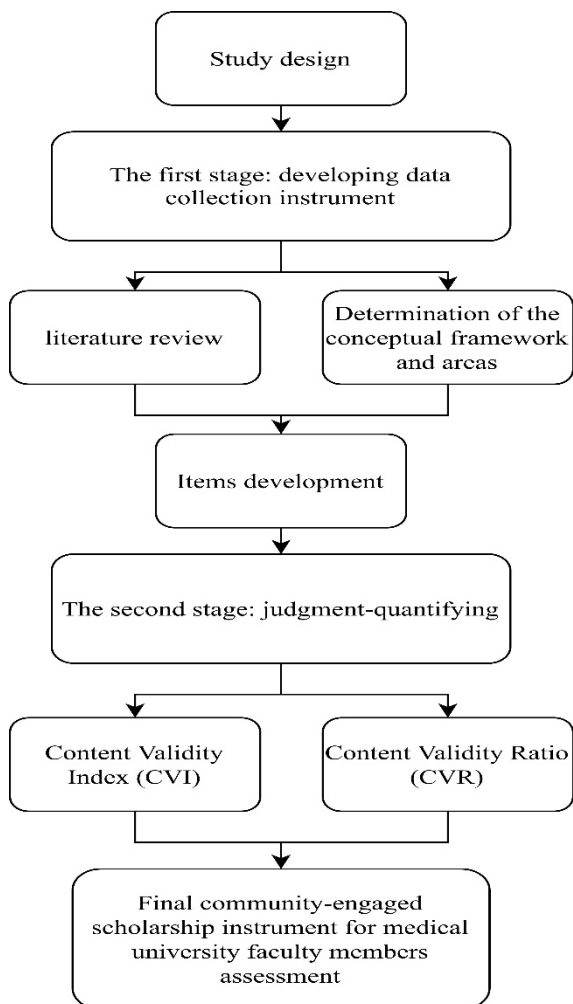


Figure 1. The steps of the study method

The second stage: judgment-quantifying: At this stage, a group of elites consisting of ten people who were experienced in the area of medical education, and assessment of faculty were invited. Ten people were selected accordingly, which is twice the minimum number suggested by Lawshe to reach the required consensus, and the validity coefficient with a higher level of confidence (23). These people assessed the developed instrument from two viewpoints: Content Validity Ratio (CVI) and Content Validity Index (CVR). To calculate the content validity index, the elite group was asked to rate each item in the constructed instrument in terms of their link to the assessed structure using a four-point

Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = very relevant). Based on the number of items whose score was 3 or 4, the content validity index should be calculated. This index was calculated both at the level of each item and in the entire developed instrument. Which is also acceptable at least for CVI with 0.78. The content validity ratio was used to examine the necessity of each item. At this stage, the elites were asked to assess each item based on a three-point Likert scale (the question is necessary, the question is useful but unnecessary, and the question is unnecessary). Then, the following equation was used to measure the content validity ratio:

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

Where CVR is content validity ratio, NE is Number of people who have selected the option of “this question is necessary”, and N is total number of elites.

The number obtained as a result of the calculations in this equation will be between -1 and +1. The larger this number is, the greater the consensus among the elites. The mean content validity ratio of all items was considered the content validity index of whole instrument (24). The criteria for accepting or rejecting each question based on accepted CVR values and the number of panel members are presented in Table 1 (25).

Table 1. Minimum CVR values according to the number of panel members

Number of panel members	Minimum acceptable CVR
5	0.99
6	0.99
7	0.99
8	0.85
9	0.78
10*	0.62*
11	0.59
12	0.56
13	0.55
14	0.51
15	0.49
20	0.42
25	0.37
30	0.33
35	0.31
40	0.29

*Since there are 10 panel members in this study, if the CVR value of each question is equal to or greater than 0.62, the question will be accepted (25).

Results

Extracted items and areas: Based on the extensive literature review, seven criteria were finally extracted for measuring the community-engaged scholarship of faculty, which were: specific goals, appropriate preparation, appropriate methodology, approach, major findings, presenting important results, and continuous critical treatment. For each of these criteria, items which can measure these areas were determined (Table 2). Finally, 20 items were developed.

CVR, CVI values and acceptance or rejection results of each question: Expert judgment was used to evaluate

the content analysis of the acquired instrument's questions. CVR and CVI values were computed for every question by putting the information derived from the expert judgment into Excel software. Table 2 presents the values of CVR, CVI, and the acceptance or rejection results of each question.

Based on Table 1, the minimum CVR values due to the number of 10 panel members is 0.62, and questions with CVR values greater than 0.62 are accepted. CVR, CVI values and acceptance or rejection results of each question in developed instrument is shown in Table 2.

Table 2. CVR, CVI values and acceptance or rejection results of each question

Item	Criterion	Question	CVR	CVI	Status
1	Specific goals	Has the faculty stated the goals of his work and its value for the development of the community?	0.8	1	Acceptance
2		Is the desired activity in line with the professional role of the faculty and the mission of his educational department?	0.8	0.9	Acceptance
3		Are the goals defined by the faculty realistic and achievable?	1	1	Acceptance
4		Does the faculty have enough skills to engage in the project?	1	1	Acceptance
5	Appropriate preparation	Have the important economic, social, cultural and political factors been included in the review of the topics?	0.8	1	Acceptance
6		Have the conditions provided for engagement of the people and other organizations?	0.8	0.9	Acceptance
7	Appropriate methodology	Are the proposed methods appropriate to the goals, questions and the desired work area?	1	1	Acceptance
8		Has it been explained how different partners engage in the program components (assessment, development, implementation and evaluation)?	0.8	1	Acceptance
9	Approach	Is the program appropriate and based on the culture of the community?	0.8	1	Acceptance
10		Is the desired activity based on creative and original approaches?	1	1	Acceptance
11	Major findings	Has the program led to positive results for the community?	1	1	Acceptance
12		Has the program led to positive results for the university?	1	1	Acceptance
13		Has the program led to the creation of new resources (for example, funding for research) for the program itself, the community, or the institution?	0.8	0.8	Acceptance
14		Does the program have required sustainability?	0.8	1	Acceptance
15		Does community believe that obtained results are important?	1	1	Acceptance
16	Presenting important and significant results	Are the process and results of this collaborative work published in the community?	1	1	Acceptance
17		Have the process and results of this collaborative work been published in academic communities?	1	1	Acceptance
18	Continuous critical treatment	What lessons have been learned by the faculty from this community-engaged scholarship?	0.8	1	Acceptance
19		Will these lessons have an impact on the professional programs of the faculty in the future?	0.8	0.9	Acceptance
20		Have the performers assessed and criticized their performance carefully and thoughtfully, and have they used the results of this reflection along with the results of others' assessments to improve their work development?	1	1	Acceptance

Introduction of the final questionnaire: After examining the validity of the questions, all questions were approved and accepted. The final instrument for assessing the community-engaged scholarship of medical university faculty in Iran consisted of 20 items which were on a 0–2 Likert scale (no = 0, somewhat = 1, and yes = 2).

Discussion

In today's world, the duties of faculty members in teaching have become wider than in the past and they are considered people who bring development and progress for the community.

Through activities, such as holding public educational lectures, engaging students in the community, producing content, and resources for enhancing public knowledge, such as books, pamphlets, applications, podcasts, active presence on television and radio, launching websites, and discourse creation in the community, faculty is encouraged to provide services to external communities (outside the university), communicate with these communities, and play a leadership role in community engaged organizations. In order to accomplish this, it is imperative to assess their endeavors, specifically the protocols governing faculty advancement, with an eye toward more than just academic, research, and management/service undertakings; encompass endeavors that contribute to the socioeconomic and cultural progress of the local community as well. A 20-item instrument was developed to assess the community-engaged scholarship of medical university faculty. The instrument utilized in this research was constructed through an exhaustive literature review and input from esteemed institutions worldwide. Its validity was assessed using quantitative methods of content validity (26-28). The present study is the first domestic and foreign study that used CVI and CVR methods to design an instrument for assessing community-engaged scholarship of medical university faculty in Iran. The mean CVR and CVI of all questions were 0.90 and 0.925, respectively, indicating high and acceptable validity for the developed instrument. Polite et al. proposed a score of 0.90 and above for the mean content validity index (29).

To assess the community-engaged scholarship of medical university faculty, the criteria of specific goals (4 questions), appropriate preparation (2 questions), appropriate methodology (2 questions), approach (2 questions), major findings (5 questions), presenting important and significant results (2 questions), and

continuous critical treatment (3 questions) were used. Table 1 shows that the minimum CVR values for a panel of ten individuals are 0.62, and questions with CVR values greater than 0.62 were approved. Therefore, based on CVR and CVI values, all 20 initially developed questions were accepted for the final instrument. To score the community-engaged scholarship of faculty in the final developed instrument, three-point Likert method was used. One of the limitations of this study was lack of domestic, and foreign studies that explain the process of developing the assessment instrument items, and calculating its content validity. However, in the prestigious universities of world, assessment instruments are sometimes placed on the sites, including American universities (30), and Canadian universities (31, 32). The other limitation was that our work was limited to domain identification, item generation, and assessment of content validity (i.e., item development). We did not implement the steps of scale evaluation (i.e., testing reliability and construct validity).

Conclusion

Considering the need for the active presence of faculty members in the community in the world's prestigious universities, the issue of assessing the community-engaged scholarship of faculty should be included in the promotion regulations sooner or later. As a result, it is essential to create evaluation tools in this field that take into account the indigenous and cultural circumstances of our nation. This study showed that the instrument for assessing the community-engaged scholarship of medical university faculty has a good content validity with twenty items.

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Examining the Mediating Role of Test Anxiety in the Relationship between Procrastination and Self-Handicapping of Students

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Abstract

Background: Procrastination is a common phenomenon affecting many aspects of personal and academic life, especially among students.

Objectives: This research aims to examine the mediating role of test anxiety in the relationship between procrastination and self-handicapping of students in a structural equation modeling approach.

Methods: The present research was a cross-sectional study of descriptive-correlational type, performed in 2022 on 200 students. The census method was used for sample selection because of the limited sample size. Three standard questionnaires were used: Solomon and Rothblum Academic Procrastination, Sarason Anxiety Scale, and Johns and Rodwelt Self-Handicapping Scale. Structural equation modeling was used through AMOS 22 with a significance level of 0.05 for data analysis.

Results: The findings indicated that procrastination had a positive and significant effect on test anxiety ($\beta = 0.46, p < 0.001$) and self-handicapping ($\beta = 0.32, p < 0.001$). Also, the impact of text anxiety on self-handicapping ($\beta = 0.49, p < 0.001$) was positive and significant. There was also an indirect effect of procrastination on the self-handicapping of students through text anxiety (0.22), which was obtained as positive and significant at 0.01 levels via the Bootstrap method.

Conclusion: Procrastination causes increased self-handicapping of students and test anxiety, which promotes further self-handicapping.

Keywords: Test Anxiety; Procrastination; Self-Handicapping

Background

Academic procrastination is an important factor associated with the academic performance of learners in educational systems (1). It is a common phenomenon that affects many academic and daily activities (2). Academic procrastination is often deemed irrational and harmful (3), and it is progressively growing among students. In this regard, some research has shown that 80-90% of students suffer from various forms of procrastination (4). Some studies have reported its prevalence as 52% (5). Although the results of previous studies have reported varying prevalence rates of procrastination among different societies (6, 7), its prevalence is higher among students than others (8).

Further, its serious and unfavorable consequences have sparked greater attention to its examination. Academic procrastination can lead to various physical problems, including digestive disorders and insomnia (9), psychological issues such as diminished self-esteem (3), anxiety (3, 8), stress (10), and depression (11), along with academic problems such as inability in organizing and achieving academic goals (12), low scores (3), and poor learning (13). Accordingly, procrastination is a maladaptive behavior with harmful consequences. Thus, addressing procrastination and gaining awareness of its negative impacts are crucial (14). These can help prevent and mitigate this phenomenon, especially among students. As mentioned above, one of the negative

consequences of academic procrastination is anxiety (7). In this regard, it has been shown that in recent years, due to sudden prolonged isolation, decreased social interactions, and changes in learning style, they have found anxiety and other negative emotions (15). Some studies have indicated that in comparison with typical college students, medical sciences students had higher levels of anxiety (16, 17). In this regard, a meta-analysis by Ven Eerde (2003) revealed that there is a positive association between test anxiety and procrastination. The higher the level of test anxiety, the greater the procrastination level reported by students (18). According to Rothblum et al. (1984, 1986), academic procrastination is positively associated with different general anxieties and specifically with test anxiety and social anxiety (19).

The results of some studies showed that high levels of procrastination make students unable to organize their academic goals and achieve them. Academic performance is more at risk among procrastinating students than their peers. The consequences of procrastination often include negative emotional, mental, psychological, and behavioral aspects such as unstable health, poor self-image, poor social perception, increased stress, and professional incompatibility. More precisely, for many students, academic procrastination is strongly related to ineffective learning outcomes such as low academic performance, low quality of academic work, lack of knowledge, time pressure, dropping out, and prolonging the academic period (18-20). Although the negative consequences of academic procrastination may not be noticeable in everyday life, the implications of its prevalence among medical students who will assume important responsibilities in the future can be irreparable (21). A study examining the relationship between academic achievement and procrastination in medical school students by Hayat et al. reported that 29.25% of medical students stated that they always or almost always procrastinated their academic tasks (22). Therefore, procrastination is not an issue that can be easily passed over. Rather, it should be given serious attention because its prevalence in society, especially among students, is very high and is increasing (23, 24).

Academic procrastination is one of the more common problems at different levels of education. It is a set of behavioral problems that several factors effectively reduce.

Accordingly, the present research deals with the mediating role of anxiety in the relationship between academic procrastination and self-handicapping among students.

Objectives

This research aims to examine the mediating role of test anxiety in the relationship between procrastination and self-handicapping of students in a structural equation modeling approach.

Methods

Design and setting: The present research was a cross-sectional study of the descriptive-correlational type performed in 2022.

Participants and sampling: A sample of 200 students majoring in laboratory sciences, anesthesia, and operation room at the faculty of paramedicine of Istahban. The census method was used for sample selection because of the limited sample size.

Inclusion criteria: The inclusion criteria included students at the faculty of paramedicine of Istahban who were willing to participate in the study.

Exclusion criteria: The exclusion criteria included incomplete questionnaire responses and refusal to participate. For data collection, after obtaining the ethics code and with the necessary coordination, the research questionnaires were distributed and collected.

Tools and Instruments: Three valid questionnaires were used for data collection.

A) Solomon and Rothblum procrastination questionnaire

This questionnaire measures students' procrastination in six areas: writing an assignment (writing papers, translation, preparation class project, thesis, etc.), studying for exams, keeping up with weekly reading assignments, performing administrative tasks (completing forms, registration for classes, obtaining an ID card, etc.), attending meetings (meeting with the advisor professor, meeting with a professor, etc.), and performing academic tasks in general. Each domain is assessed with three questions in a 5-point Likert scale. In general, the range of scores is between 18 and 90. Higher scores mean higher procrastination. Solomon and Rothblum in their study, reported the validity and reliability (0.84) of this questionnaire at a favorable level (25). This questionnaire has already been translated and used in many studies in Iran, and its psychometric properties have been confirmed in various studies (26, 27). We used the translated and validated version. However, we also used confirmatory factor analysis to assess the construct validity. In the present study, the Cronbach's alpha coefficient was used and obtained as 0.85.

B) Sarason's test anxiety standard scale

One of the valid instruments for measuring test anxiety is the Sarason questionnaire, which contains 37 two-option items (28). This instrument captures the person's psychological states and physiological experiences during the test and before and after it based on a self-report method. The higher the person's score, the greater the anxiety. On this scale, the scores range from 0 to 37. The cutoff points of this questionnaire have been determined as follows: mild anxiety (score 12 and lower), moderate anxiety (scores 13-20), and severe anxiety (score of 20). The reliability of this questionnaire has been confirmed in different studies. The studies performed in Iran have confirmed its desired validity (77). We used the translated and validated version. However, we also used confirmatory factor analysis to assess the construct validity. In the present study, the test-retest reliability coefficient was 0.85.

C) Johns and Rodwelt self-handicapping standard questionnaire

To measure self-handicapping, the Jones and Rodwelt questionnaire was used (29). This questionnaire contains 25 items, and has been designed based on a Likert scale, ranging from absolutely disagree (0) to absolutely agree (5). The total score of the questionnaire indicates the level of self-handicapping. Specifically, higher scores indicate high levels of self-handicapping, while low scores represent low levels. The maximum score is 125, and the minimum is 25. The reliability of this questionnaire has been confirmed in different studies. Studies in Iran also suggest its desirable validity (30). We used the translated and validated version. However, we also used confirmatory factor analysis to assess the construct validity. To determine the reliability of the mentioned questionnaire, the Cronbach alpha coefficient, whose value was obtained was 0.83, was used, suggesting the desirable reliability of this instrument.

Data analysis: Pearson correlation coefficient and Structural Equations Modeling (SEM) were used for data analysis through SPSS 23 and AMOS 22.

Ethical considerations: The ethics committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1400.480) received permission to conduct the research to observe the ethical considerations. Before distributing the questionnaire, the researcher explained the research objectives to the participants and informed them that their participation was absolutely voluntary. In addition, the participants were assured that the questionnaire would be

anonymous, with no mention of their names or personal information.

Results

The descriptive findings indicated that most subjects ($n = 124$ and 62%) were female students. Also, 139 subjects (69.5%) were single. Regarding the academic major, the results are presented in Table 1.

Table 1. Frequency of academic major variable

Academic major	Frequency	Percent
Anesthesiology	28	14
Laboratory sciences	36	18
Operation room	32	16
Nursing	67	33.5
Management	20	10
Medical emergencies	11	5.5
Health information technology	6	3
Total	200	100

Confirmatory factor analysis for the research questionnaires: First, the research instruments should undergo confirmatory factor analysis to initiate structural equation modeling and determine construct validity. Confirmatory factor analysis was used to confirm each of the variables and the items related to each of them. The goodness of fit indices of the final analysis are presented in Table 2.

Table 2. Fitting indices of the procrastination and self-handicapping questionnaires

Index	Procrastination	Self-handicapping
	Estimation	
χ^2/df	2/41	2/32
RMSEA	0.06	0.07
GFI	0.93	0.96
AGFI	0.90	0.91
CFI	0.95	0.96
NFI	0.91	0.96
RMR	0.02	0.02

χ^2/df : Chi-square to the degree of freedom ratio; RMSEA: Root mean square error of approximation; GFI: Goodness of fit index; AGFI: Adjusted Goodness of fit index; CFI: Comparative fit index; NFI: Normed fit index; RMR: Root mean square of residuals

Based on Table 2, the calculated χ^2/df values were 2.41 and 2/31; χ^2/df smaller than 3 suggests good model fitness. Furthermore, the root mean square error of approximation (RMSEA) should be lower than 0.08; in the model presented here, these values were 0.06 and 0.07. The GFI, AGFI, CFI, and NFI values should be greater than 0.9; in the model examined here, the values were larger than this determined number.

Table 3. Factor loads and common variance estimated for the questionnaire items

Procrastination questionnaire			Self-handicapping questionnaire		
Item	Factor load	R ²	Item	Factor load	R ²
1	0/79	0/62	1	0/23	0/05
2	0/89	0/79	2	0/23	0/05
3	0/68	0/46	3	0/32	0/10
4	0/59	0/35	4	0/35	0/12
5	0/71	0/51	5	0/43	0/18
6	0/73	0/53	6	0/29	0/09
7	0/67	0/45	7	0/22	0/05
8	0/81	0/66	8	0/33	0/11
9	0/83	0/69	9	0/22	0/05
10	0/80	0/65	10	0/43	0/19
11	0/83	0/69	11	0/29	0/09
12	0/78	0/61	12	0/81	0/65
13	0/59	0/35	13	0/38	0/14
14	0/84	0/71	14	0/72	0/52
15	0/74	0/55	15	0/68	0/46
16	0/85	0.72	16	0/70	0/49
17	0/91	0.82	17	0/76	0/58
18	0/73	0.54	18	0/74	0/55
			19	0/88	0/77
			20	0/77	0/59
			21	0/71	0/51
			22	0/71	0/50
			23	0/58	0/34

Thus, this research's data had a good fit with the structural analysis of the questionnaires, suggesting congruence between the items and the constructs. Note that items 24 and 25 in the self-handicapping questionnaire were eliminated from the analysis since they did not have a significant factor load.

Table 3 reports the factor loads of the items related to the questionnaires (procrastination and self-handicapping) and their explained variance.

In Table 4, descriptive indices of the research variables are presented, indicating that the data enjoys the necessary distribution for conducting structural equation modeling.

Table 4. Descriptive indices of the research variables

Variable	Min	Max	Mean	SD
Procrastination	20	83	56.17	13.02
Text anxiety	7	34	20.40	7.47
Self-handicapping	43	105	79.79	15.14

Before testing the theoretical model of the research, there should be a significant correlation between variables of the theoretical model. Accordingly, Table 5 reports the correlation matrix of the research variables.

According to the above table, the relationship between procrastination (0.51) plus test anxiety (0.62) and self-handicapping was positive and significant at 0.01. Also, the relationship between procrastination and test anxiety (0.46) has been positive and significant at 0.01 level.

Table 5. Correlation matrix of the research variables

No.	Variable	1	2	3
1	Procrastination	1		
2	Text anxiety	0.46**	1	
3	Self-handicapping	0.51**	0.62**	1

Next, to predict the self-handicapping of students, the proposed conceptual model was investigated through structural equation modeling based on the maximum likelihood method. Figure 1 demonstrates the model tested in the research. Table 8 also outlines the results related to the direct coefficients of effects.

Based on Table 6 and Fig, the direct effect of procrastination (0.32) and test anxiety (0.49) has been positive on self-handicapping and significant at 0.001 level. The direct impact of procrastination on test anxiety (0.46) was positive and significant at 0.001 level. Procrastination and test anxiety overall accounted for

48% of the variance of self-handicapping of students. Procrastination alone also explains 21% of the variance of test anxiety. Based on the above table, the indirect effect of procrastination on the self-handicapping of students was through test anxiety (0.22), which was positive and significant at 0.01 level based on the bootstrap method.

This means that procrastination through test anxiety had a positive and significant indirect effect on the self-

handicapping of students. In other words, procrastination has resulted in increased test anxiety in students, and this increase in test anxiety itself leads to their self-handicapping. Also, to investigate the fitness of the tested model, three groups of fitness indices, including absolute, comparative, and parsimonious, were used, with their results presented in Table 7.

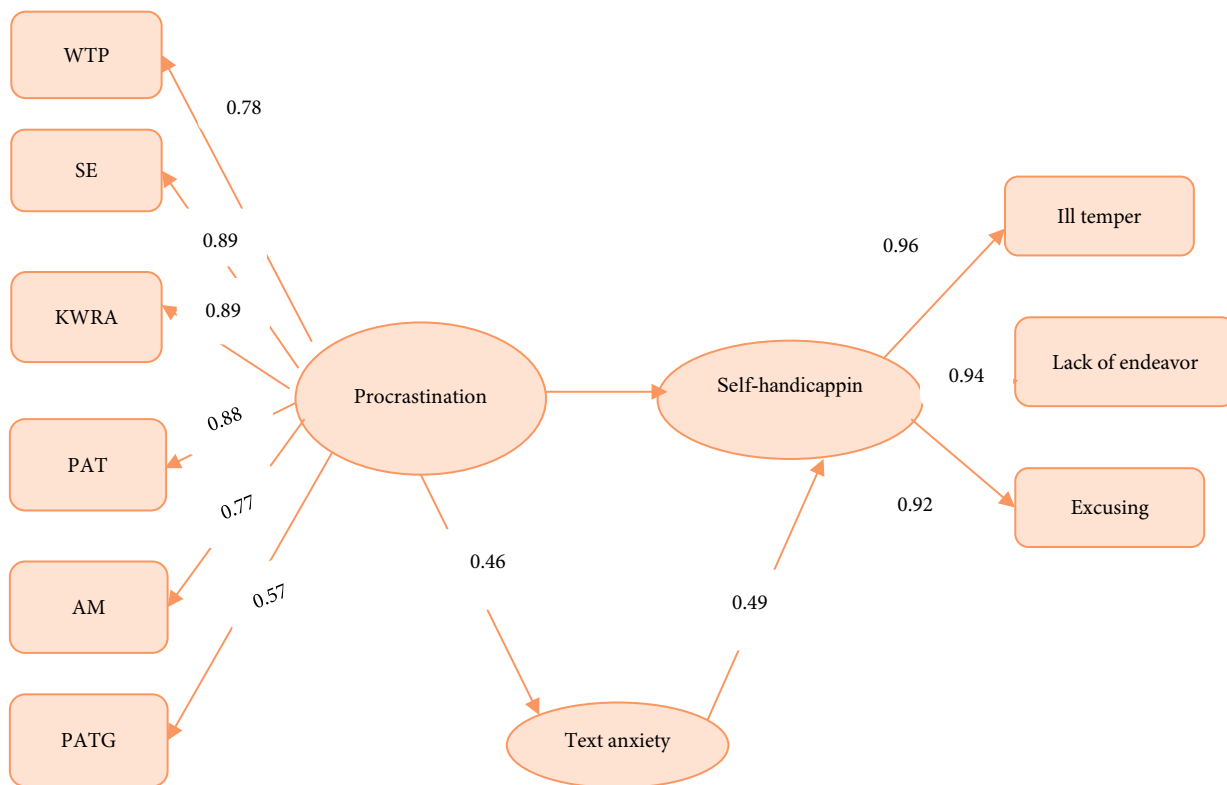


Figure 1. The tested model of self-handicapping of students

Based on the above table, the goodness of fit index (GFI) was 0.96 for the tested model, which is larger than 0.90. The adjusted goodness of fit index (AGFI) was 0.93, larger than 0.80. Also, the standardized root mean square error (SRMR) was 0.01, lower than 0.05. The comparative fitness index (CFI) was 0.99, larger than 0.99. The normalized fitness index (NFI) was 0.97, larger

than 0.90. The non-normalized fitness index (NNFI) was 0.99, larger than 0.90. The chi-square of the degree of freedom (X^2/df) is 1.46, which is lower than 3. The parsimony-normed fit index (PNFI) is 0.69, larger than 0.60, and the root means square error of approximation (RMSEA) is 0.05.

Table 6. Direct, indirect, and total effects, as well as explained variance of variables

Path	Direct effect	Indirect effect	Total effect	Explained variance
On Self-handicapping through				0.48
Procrastination	0.32***	0.22**	0.54***	
Text anxiety	0.49***	-	0.49***	
On Test anxiety through				0.21
Procrastination	0.46***	-	0.46***	

Table 7. The goodness of fit indices of the tested model of the research

Absolute fitness indices				
Index	GFI	AGFI	SRMR	Index
Obtained value	0.96	0.93	0.01	Obtained value
Acceptable limit	Greater than 0.9	Greater than 0.8	Less than 0.05	Acceptable limit
Comparative fitness indices				
Index	CFI	NFI	NNFI	Index
Obtained value	0.99	0.97	0.99	Obtained value
Acceptable limit	Greater than 0.9	Greater than 0.9	Greater than 0.9	Acceptable limit
Adjusted fitness indices				
Index	X ² /df	PNFI	RMSEA	Index
Obtained value	46.1	0.69	0.05	Obtained value
Acceptable limit	Less than 3	Greater than 0.6	Less than 0.08	Acceptable limit

Discussion

The present research focused on investigating the mediating role of test anxiety in the connection between procrastination and self-handicapping. The results showed that procrastination had a positive and significant effect on test anxiety, and, with the increase in academic procrastination, the test anxiety of students also increased. This is in line with the findings of previous research (14-17) as well as theoretical statements, suggesting that procrastination is always associated with negative consequences, including anxiety. In this regard, a meta-analysis performed by Van Eerde (2003) indicated that there is a positive relationship between test anxiety and procrastination. The higher the test anxiety level, the greater the procrastination level reported by students (18). According to Rothblum et al., academic procrastination is positively associated with general anxiety, specifically test anxiety and social anxiety (19). It can be assumed that students who have high levels of procrastination experience more anxiety. They are also more insecure about positive and constructive solutions to problems. They frequently delay the implementation of programs, and at the last minute, when the deadlines approach, they begin their tasks, making efforts to make up for the lost time almost futile.

Anxiety can be aggravated by high expectations from others as well as excessively high standards about the work outcomes. According to one study (28), procrastination especially emerges in situations that require evaluation and measurement of personal abilities. Thus, it can be assumed that postponing academic activities is not typical for students with low levels of procrastination. Thus, the problems resulting from late and untimely assignment fulfillment are rare.

Accordingly, it can be stated that students with low procrastination experience less anxiety.

This procrastination leads to academic failure. Thus, these students get the impression that they do not have adequate competence and qualifications, which severely damages their academic self-confidence. The relationship between anxiety and procrastination is complex, as they mutually affect each other. Procrastinators experience severe anxiety due to the sense of threat to their self-esteem. This level of anxiety makes them postpone the possibility of doing that assignment to liberate themselves from its resulting suffering. The study results showed that procrastination had a positive and significant effect on self-handicapping (0.32); with an increase in academic procrastination, the self-handicapping of students also increased. This is consistent with the results of earlier studies (16, 17, 21, 22, 26). In a meta-analysis, Van Eerde (2003) investigated the factors associated with procrastination and found that the greatest positive association existed between procrastination and self-handicapping (18). Some research has mentioned academic procrastination as a self-handicapping strategy, which has been regarded as a predictor of self-handicapping (20). For example, Aka et al. (2012), in research on undergraduate students, concluded that there was a positive and significant correlation between self-handicapping and academic procrastination. Among the research variables, academic procrastination claimed the largest share in predicting self-handicapping (29). In this respect, it can be stated that procrastinating students do not seek qualification and mastery over their courses and do not feel a sense of responsibility for gaining success. They have little perseverance and, in case of failure, do not attempt further. In addition, most of their goals are directed to external factors, including the acquisition of grades and

scores, becoming top students, getting approval from a professor, etc., and even avoiding the consequences of failure. This increases the active strategies of opportunities for externalizing failure (I failed in the exam because I was sick) and success for internalization (I am smart and do not study hard for exams), thereby promoting the ground for self-handicapping in the person. Procrastinators may assume that their actions have had no effect on changing their situation and hence focus on regulation and management of their emotions. This means that instead of an assignment-based coping orientation, they tend to adopt an emotion-based coping orientation. One form of this emotion-based coping, which represents a deficiency in the self-regulation function, is self-handicapping, which means the person places an obstacle to delay their desired performance. The driver of self-handicapping is maintaining self-esteem. In such a case, the person sets failure in doing the desired performance as an external factor. Self-handicapping can be regarded as a potential cause or reflective cause of procrastination. If these people succeed in assignments, they feel a sense of self-efficacy and pride; however, if they fail, they feel shame and further humiliation. Possibly, the reason why procrastinators adopt a self-handicapping strategy is that they have always received negative feedback and consider the probability of its reception in response to failure always imminent.

Other results showed that test anxiety had a positive and significant effect on self-handicapping. In addition, test anxiety plays a mediating role between procrastination and self-handicapping of students. Also, other studies (25, 35), including the research by Barutcu and Demir (2020), showed that test anxiety was a significant predictor of self-handicapping among undergraduate students (23). The self-worth theory (Covington, 1992) suggests that the students' self-worth can be affected by failure. This is because failure is regarded as a symbol of incompetence, which is considered low self-worth (30). In the current academia, emphasis on success and personal performance and perception of personal value have increased (31-36).

The relationship between academic procrastination and anxiety presents further evidence suggesting that procrastination is beyond deficiency in time management and study skills and also encompasses cognitive and emotional elements. Indeed, according to Saputri (33), procrastinators in their study behavior are not different in terms of anxiety. In another respect, it

can be stated that students who experience fear of failure as well as fear of negative assessment delay studying lessons up to the night of the exam because of their severe anxiety.

Thus, the students with higher test anxiety levels tended to adopt self-handicapping and pessimistic defensive strategies, which could protect their self-worth feelings against the expected failure by reflecting the attribution away from their perceived incompetence (34, 36). Overall, it can be concluded that procrastination not only directly leads to increased self-handicapping of students but can also indirectly affect self-handicapping by increasing test anxiety. Previous studies have shown that there is a significant correlation between procrastination, academic anxiety, and self-handicapping (25). Nevertheless, to our knowledge, no research has proven its indirect association.

Limitations: One of the limitations of this research was that the research was limited to the city of Istahban and that the present research was limited to the sample of students of the Istahban University of Medical Sciences. Therefore, it is recommended to conduct additional studies in various cities to ensure that the findings can be applied more broadly. It is also recommended that similar research be conducted in other groups with different characteristics. This research also had limitations, such as the self-report method and that questionnaires were used to measure the research variables, and there is a possibility that these values are over reported.

Conclusion

The present research spotlighted the relationship between academic procrastination and self-handicapping through the mediating effect of test anxiety. Our research demonstrated that academic procrastination affects self-handicapping and revealed that test anxiety, to some extent, mediates the effect of procrastination on self-handicapping. In line with the research results, it is suggested that workshops be held by health administrators in connection with psychological interventions to reduce students' emotional problems such as procrastination, test anxiety, etc., as well as to promote motivation and progress goals in universities and counseling centers. It is possible to take pivotal treatment towards a health-oriented approach and save on the high cost of healthcare. It is suggested to identify and reduce the sources of students' exam anxiety, including an emphasis on grades and perfectionism, so that the level

of self-disability and procrastination of students decreases. In this regard, it is suggested that interventional research be conducted on strategies to reduce exam anxiety.

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Community-related Medical Education Classification: A Critical Review

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Abstract

Background: Community-related medical education has been defined under various terms, such as community-oriented medical education, community-based medical education, social accountability education, and community-engaged medical education. These terms have similar definitions and can be used interchangeably. The graduation of physicians who are familiar with the problems of the community is considered a necessity in modern medical education. As a result, numerous activities have been carried out worldwide, each given a different name.

Objectives: This study intended to provide a more comprehensive classification of community-related medical education by examining the maximum number of educational programs and activities worldwide. The classification helps create a scientific and systematic view of this category and serves as a guide in planning and implementing such education.

Methods: The present study is conducted using Carnwell and Daly's critical review method. The review was performed in different stages, including defining the review scope, identifying sources, reviewing, and constructing the texts. By reviewing documents and examining their similarities and differences, previous classifications are complete and updated.

Results: Community-related medical schools are divided into socially responsible, socially responsive, and socially accountable schools, with medical curricula that are community-oriented, community-based, and community-engaged, respectively. All schools are subdivided into education, research, and service-oriented programs.

Conclusion: Community-related educational programs can be designed and implemented at different levels according to the context.

Keywords: Community-Oriented Medical Education; Taxonomy; Classification; Social Responsibility

Background

At the World Conference on Medical Education in 1988, 12 strategies were adopted for applying fundamental changes in the medical curriculum. One strategy was related to the development of areas where education takes place, including all community resources other than hospitals (1). Additionally, the World Health Organization (WHO) has recommended a social accountability approach for medical universities to align their curricula according to the population's needs and illness prevention principles. This recommendation is especially crucial for colleges in disadvantaged areas suffering from health inequality (2, 3).

Literature affirms that more than 90% of healthcare services are provided in a community. However, the curriculum remains unchanged, with a significant focus on clinical expertise (4, 5). At the same time, community-related medical education can increase students' knowledge and attitudes toward practical medicine in rural areas (6).

In several medical schools, public health education is conducted by epidemiologists, researchers, and academics. However, if general practitioners with practical experience in the field could perform this training, community health would find its way toward improvement alongside individual health and wellbeing

(7). In fact, one important strategy to tackle health inequality is to promote active community academic involvement and develop this as the fourth mission of universities, in addition to education, research, and service delivery (8, 9). In the 1960s and 1970s, medical education was described as community-oriented medical education, and its development to community-based medical education began in 1980. Community-engaged medical education was the third wave that emerged in the first decade of the 20th century with an emphasis on the concept of mutual dependence and cooperation between the university and the community. This educational model is consistent with the socially accountable model proposed by the WHO (10).

In Iran, medical education has undergone a turbulent path in responding to the real needs of society. The reason may be obstacles such as lack of active engagement among clinical groups, insufficient budget, lack of suitable physical resources and required facilities, or even legal issues. Achieving success in social accountability depends mainly on the precise priority setting and the rational allocation of available resources. Therefore, it is necessary to pay closer attention to medical education and its objectives in a wide-ranging and profound manner (11). The results of a study conducted at Kerman University of Medical Sciences revealed that socially accountable education was assessed to be in a weakness-threat position (12). Although Iranian universities focus on community-based medical education, there is still a long way to go before reaching a satisfactory and desirable condition. Considering the existing gap, placing physicians at the core of society can have a significant impact on the compliance of these critical healthcare service providers with the actual needs of society (13).

In the last century, community-related medical education has been defined under various terms that have similar definitions and can be used interchangeably. In 2000, a complete classification of community-based medical education was created (14). With the creation of broader and more complex concepts of community-related medical education, some of these terms were excluded from the classification. In 2008, Roger Strauss classified three categories, including community-oriented medical education, community-based medical education, and community-engaged medical education, in a hierarchical manner (15). The latest classification dates back to 2015 when community-related medical

education was divided into four categories. Community service medical education is the fourth category added to the previous classification. However, it seems that an even better classification can be provided, enabling us to implement these concepts and respond to the population's needs more effectively (16).

Objectives

This study aimed to present a more comprehensive classification of community-related medical education by reviewing existing educational programs related to community needs worldwide, with the objective of determining their relevance to different social spectrums.

Methods

Despite the growing attention given to community-related medical education in recent years, there still exists a significant knowledge gap that cannot be filled by simply answering a question or presenting a simple description of the existing problem. Thus, in the present study, we chose and applied the critical review methodology offered by Grant and Booth (17). The review was carried out using Carnwell and Daly's critical review method, published in 2001. The review was performed in different stages, including determining the scope of the review, identifying sources, reviewing and criticizing documents, and applying the literature to the proposed study (18).

Defining the Scope of the Review: This review includes theoretical and experimental studies on any type of community-related medical education. Our focus is on the classification and differentiation of concepts related to community-related medical education, such as community-oriented, community-based, and community-engaged medical education and social accountability education.

Identifying and Selecting Sources of Relevant Information: The Pubmed, Google Scholar, Web of Science, SID, ERIC, and Scopus databases were searched using keywords, including community-oriented education, community-based education, community-engaged education, social responsibility, service learning, medical, and taxonomy. The search initially yielded 3010 documents. Table 1 shows the search strategies.

It should be noted that university websites and books were also included in the review. The search was carried out between the years 2000 and 2022, and the searched languages were both English and Persian. Figure 1 shows the study identification process.

Results

After a comprehensive review of all documents in the study, they were divided into three categories as follows:

- 1- Defining and classifying any type of community-related medical education
- 2- Providing a social responsibility scale for universities and their relation to community-related medical education programs
- 3- Distinguishing features in educational programs in the community

1. Defining and Classifying any Type of Community-related Medical Education

Different classifications of community-based medical education were identified. Three articles presented a relatively complete classification each, while a large number of other articles used these classifications repeatedly. The first document classified community-based medical education into three subcategories: education, research, and service (14). Subsequently, three classifications were determined, including community-oriented medical education, community-based medical education, and community-engaged medical education (15). The latest classification, developed in 2015, divides community-related medical education into four categories: community-oriented medical education, community-based medical education, community-engaged medical education, and community service medical education. During this review, it was revealed that some of the consequences of the community's relationship with universities were not included in the previous classifications. As a result, the reviewers created a fourth classification, which indicated a direct relationship with the community, creating an immediate benefit for community partners (16). Our criticism of this classification is that the fourth classification only deals with service provision in the community. Thus, it can be placed under the service delivery subtype of any community-related medical education. The time to achieve the beneficial effects of service provision and the level of community involvement can be used as criteria for differentiation of the fourth classification. Therefore, there is no need to separate it as a fourth class. We have extended the subclasses of Magzoub to other classes of curricula related to the community.

2. Providing a social responsibility scale for universities and their relation to community-related medical education programs

In our classification, every type of community-related education was adjusted based on social obligation scales. Bolen first proposed this link. In 2016, Bolen considered the response to the population's social needs in the form of three spectrums called the social obligation scale. At one end of the spectrum is social responsibility, which attempts to identify the needs, issues, and problems of society. Regarding social responsiveness, it is crucial to recognize the population's needs and problems and determine how to plan effectively for the implementation phase at the community level. At the other end of the spectrum is social accountability, which emphasizes the effectiveness of implemented programs in properly solving shortcomings, in addition to identifying the needs and problems of society and planning for improvement. Therefore, the educational program of each medical school should be aligned with its social obligation scale (19). After reviewing the literature and expanding the model of medical education with an emphasis on community participation, our view was that community-engaged medical education is synonymous with contextualized medical education, as introduced by Bolen. According to the WHO, social accountability is also linked to community-engaged education (2). Until then, and even afterward, these concepts were not properly used because these social obligations and their coordination with the curriculum were not known clearly, as confirmed by six other articles. The review and criticism of these six articles yielded this result (2, 19-23).

3. Distinguishing features in educational programs in the community

All relevant community-related medical education definitions were extracted and entered into a table. Then, any relevant examples relating to medical universities and schools worldwide, including different curricula, were added to create a complete, informative table. Next, similarities and differences found in the review process were added as a definite column in the table. After all examples were provided and placed in front of each definition, a re-checked process with a back-and-forth approach was conducted until reaching a comprehensive classification of community-related medical education. Table 2 shows the summary of all included documents.

It should be noted that, for bias control, the searching process and document review were conducted independently by two researchers with expertise and knowledge in community-related medical education.

Each community-related medical education was considered a separate educational program, and the differences between their components were determined by reviewing the documents. An effort was made to avoid duplicate characteristics between the different types. Distinguishing features and final classifications are shown in [Table 3](#) and [Figure 2](#).

Subcategories of each education program are shown in [Figures 3-5](#).

Applying the Literature to the Proposed Classification

Once the classification was finalized, numerous examples found in the literature review were included to test it, as shown in [Table 4](#). This new classification can include almost every community educational activity.

Discussion

After conducting a critical review of the classifications of community-related medical education, previous classifications were expanded, and some amendments were made. This study differentiated between various classifications by creating definite criteria. Although the developed indicators for the first level seemed cleaner in differentiating various types of community-related medical education, distinctions between different subcategories of education, research, and service provision were less clear-cut.

For instance, a university may take an active part in participatory community-based research and act as community-engaged medical education; however, in service provision, it might be regarded as community-based medical education. Reviewing the literature on community-related medical education worldwide, we distinguished the differences between various types of education. In general, the distinguishing feature of community-engaged medical education is the active participation of community members in all stages of the educational program, including defining needs, goals, and teaching strategies, conducting the students' evaluation process, and even admitting students. Another differentiating factor is the duration of training that takes place outside the hospital, which, in this study, was suggested to be more than 50%. For example, community participation does not occur in community-oriented education. In such an educational approach, some training sessions might be held in hospitals to convey some information about the social and behavioral factors of a community, or research priorities might be determined by considering the population's health needs. However, in practice, no intervention is put into action. These activities are usually carried out

in the first year of the general practice curriculum by teaching socio-economic determinants of health in theory, and they are not highlighted as clinical aspects of the training course. In some cases, interventions might take the form of providing basic public health services and giving priority to prevention and health promotional strategies. In community service medical education, as a separate classification of Ellaway, although there are some types of active community participation, they do not last long after the end of the program, and the community is not involved in all educational activities of the university. Additionally, the duration of training outside the hospital is less than 50%. On the other hand, in universities with social accountability and a community-engaged medical education curriculum, such as Flinders in Australia, some students voluntarily choose parallel rural educational programs for one year. This means that one university has two spectrums of community-related medical education simultaneously (24), which can be considered in Iran's medical universities. Therefore, since social accountability and responsibility are two sides of a particular spectrum, the three mentioned types of community-related medical education are placed into the same continuum. Ideally, it is helpful to entirely separate all classifications of community-related medical education. However, this does not usually occur in practice, as it is a time-consuming process and brings many challenges. An example of this is Kendra University of Bangladesh, where the program could not continue to progress toward its social goals as before (2).

Furthermore, many universities in different countries, such as Japan, China, and Germany, which were previously categorized as community-based medical education, are now included in our classification as community-oriented education.

Despite the varying degrees of social responsibility in different universities, they all acknowledge that such educational programs have been effective in changing medical students' attitudes toward prevention and health promotion, elimination of health inequality, and provision of specialized health personnel in rural and remote areas (16, 24).

Higher education in the community leads to the improvement of health indicators and the return of physicians to deprived areas (86). One practical recommendation for tackling injustice and health inequality, particularly in less privileged communities, is to establish universities with social accountability that promote educational programs with an emphasis on

community engagement.

Limitations: Various structural, cultural, and social perspectives in different countries and even in different schools of the same country can cause problems in providing a comprehensive classification. Moreover, we examined the situation of universities based on written documents, which may not accurately reflect reality.

Conclusion

By providing such classifications, confusion resulting from multiple definitions can be claimed to have been largely reduced. This classification helps design and implement community-related educational programs at different levels according to the context.

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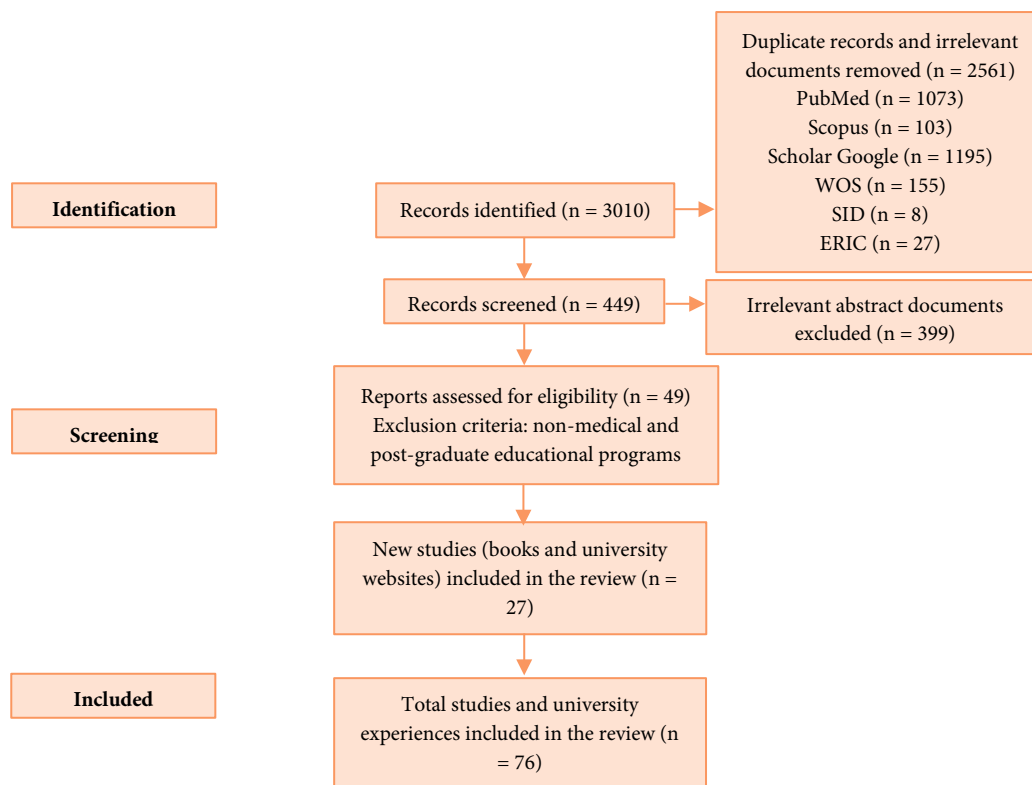


Figure 1. PRISMA study identification and selection process

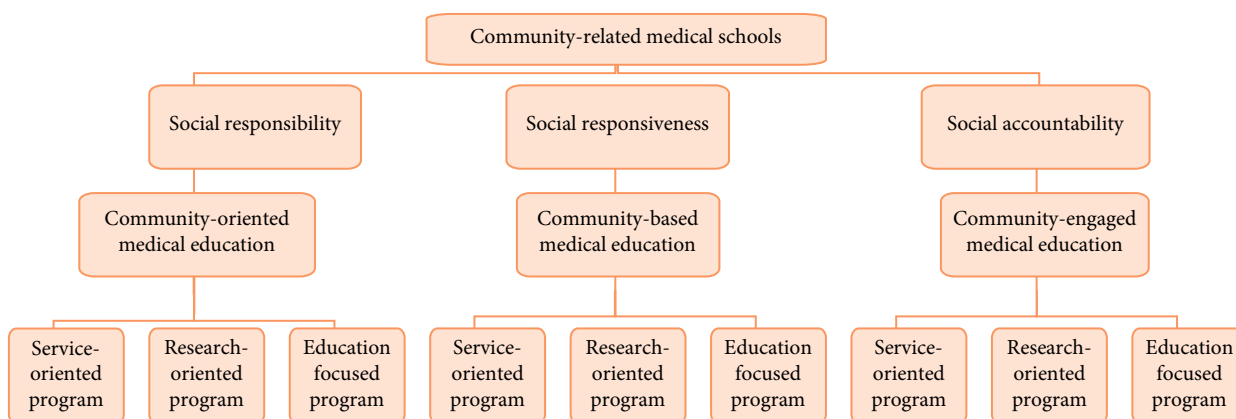


Figure 2. Different types of community-related medical education

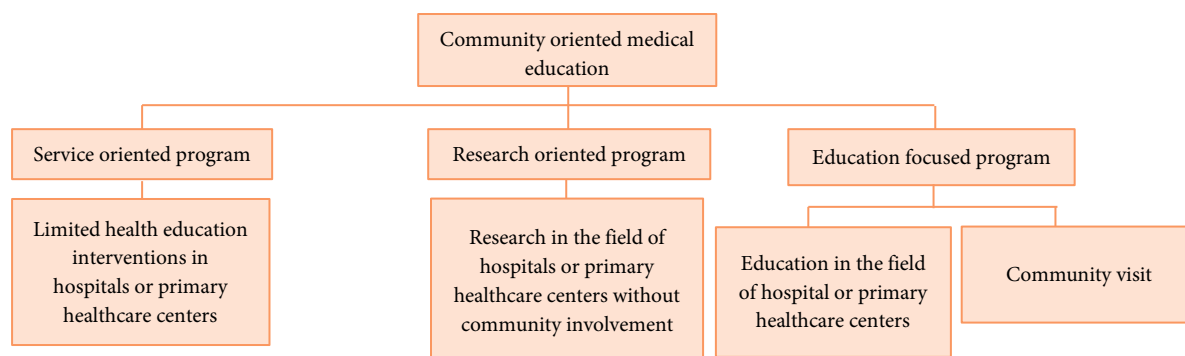


Figure 3. Subcategories of community-oriented medical education

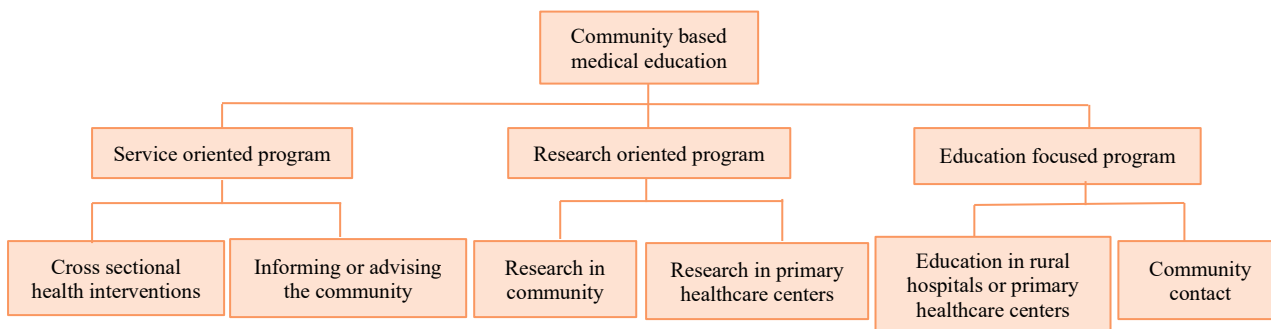


Figure 4. Subcategories of community-based medical education

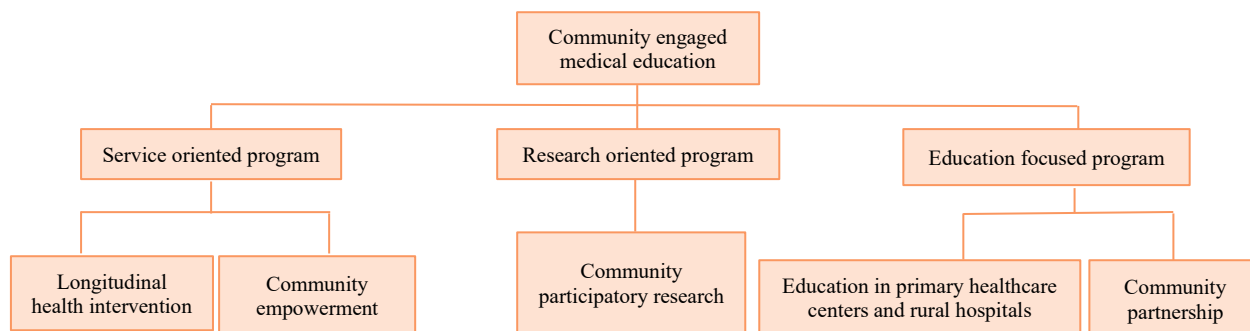


Figure 5. Subcategories of community-engaged medical education

Table 1. Search Strategies Based on Each Database

Database	Syntax
PubMed	"Community-oriented*" [Title/Abstract] OR "community-based*" [Title/Abstract] OR "community-based*" [Title/Abstract] OR "community-oriented" [Title/Abstract] OR "community-engaged education" [Title/Abstract] OR "service learning" [Title/Abstract] AND "social responsibility" [Title/Abstract] AND "medical" [Title/Abstract] AND "taxonomy" [Title/Abstract] Filters: in the last 22 years
Scopus	TITLE-ABS ("Community-oriented" OR "community-based" OR "community-based" OR "community-oriented" OR "community-engaged education" OR "service learning" AND "social responsibility" AND "medical" AND "taxonomy" (LIMIT-TO (PUBYEAR, 2000- 2022) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")) AND (LIMIT-TO (LANGUAGE, "English"))
WOS	(TI= ("community-oriented" OR "community-based" OR "community-based*" OR "community-oriented" OR "community-engaged education" OR "service learning" AND "social responsibility" AND "medical" AND "taxonomy") Document Types: Articles or Proceedings Papers or Review Articles or Data Papers. Languages: English. Timespan: 2000-01-01 to 2022-12-30 (Publication Date)
Google Scholar	"Community-oriented" OR "community-based" OR "community-based" OR "community-oriented" OR "community-engaged education" OR "service learning" AND "social responsibility" AND "medical" AND "taxonomy" in Title Abstract Keyword - (Word variations have been searched)

Table 2. Summary of Reviewed Articles

No.	First author	Year	Publication	Country	Objectives	Study design
1	Magzoub, M. E. (14)	2000	Journal article	USA	Taxonomy of community-based medical education	Reports in the literature of 31 active programs
2	Paul Worley (24)	2000	Journal article	Australia	Aims of the program Parallel Rural Community Curriculum; student selection; practice recruitment; curriculum structure, and academic content, together with lessons learned from the evaluation of the first cohort of students experience of the course	Qualitative study
3	Boyle, F. M. (25)	2002	Journal article	Australia	Describing a community-based learning program for medical students at the University of Queensland, Australia	Case study
4	Nor Mohd Adnan Azila (26)	2006	Journal article	Malaysia	Curricular approaches implemented in Malaysian medical schools	Descriptive (Review article)
5	LUBNA, A. Baig (27)	2006	Journal article	Pakistan	Development of the Community-oriented Medical Education Curriculum of Pakistan	Case report
6	AbdelRahman, S. H. (28)	2007	Journal article	Sudan	Assessing the effects of implementing the basic development needs program (a community program) in an area of Sudan	Quantitative study
7	Seifer, S. D. (29)	2007	Book chapter	USA, Dartmouth Medical School	Concepts and models for service-learning in medical education service-learning by first-year medical students	Non stated
8	Daniel Blumenthal (30)	2007	Book chapter	USA, Morehouse School of Medicine	Describing the philosophy, development, implementation, and evaluation of an interdisciplinary, community-based service-learning course in community health	Non stated
9	Franklin R. (31)	2007	Book chapter	USA, Ohio State University	A description of two programs at the Ohio State University offering service-learning opportunities for medical students	Non stated
10	Judy Lewis (32)	2007	Book chapter	USA, University of Connecticut	An urban partnership: An analysis of the experience and lessons that may be generalized to programs in other communities	Non stated
11	Bruce Bennard (33)	2007	Book chapter	USA, Quillen College of Medicine, East Tennessee State University	Introduced a fifth consecutive cohort of first-year medical students to a three-year multi-professional curriculum emphasizing health professions education within a community-oriented service environment	Non stated
12	Joellen B. (34)	2007	Book chapter	USA, East Tennessee State University	Describing the results of an effort by the faculty from the colleges of Medicine, Nursing, and Public Health, together with the WK. Kellogg Foundation's Community Partnership Initiative at East Tennessee State University to create synergy rather than antagonism among these usually conflicting demands on faculty time	Non stated
13	Thomas P. (35)	2007	Book chapter	USA, University of Pittsburgh	Community partnership in service to the homeless	Non stated
14	Sharon Dobie (36)	2007	Book chapter	USA, Washington	Developing programs that address an identifiable unmet need in a local underserved community	Non stated

15	Dongre, A. R. (37)	2008	Journal article	India	Students' perception of community medicine teaching	Qualitative study
16	Heestand Skinner, D. (38)	2008	Journal article	Nigeria	Identifying and describing the CBE programs in accredited Nigerian medical schools and reporting students' assessments of the knowledge and skills gained during their community-based educational experience	Quantitative study
17	Marahatta, S. B. N P (35)	2009	Journal article	Nepal	Reviewing the existing community-based medical education in health institutions in Nepal	Comparative study
18	Jay S. Erickson (40)	2011	Journal article	USA, Washington	Historical development of the rural medical programs at the University of Washington School of Medicine (UWSOM) and the design of a new rural LICC experience in the existing rural longitudinal medical school curriculum	Case report
19	Stewart, R. (41)	2011	Journal article	USA, Johns Hopkins	Examining the rationale, development, and challenges during the implementation of longitudinal ambulatory clerkship	Case report
20	Hunt J. B. (42)	2011	Journal article	USA	Understanding the educational goals of projects described as "service learning" or "community-based medical education" and learning the relationships between medical schools and community members	Systematic review
21	Ní Chróinín D. (43)	2012	Journal article	Dublin	Developing, implementing, and evaluating a module with a broad community focus based on primary and secondary care	Quantitative study
22	Chastonay, P. (44)	2012	Journal article	Switzerland	Describing the conception, elaboration, and implementation of the community health program and its evolution over 15 years and evaluating its outcomes	Educational program evaluation
23	Faris, A. (15)	2013	Journal article	Malaysia	Appreciating the structure and functions of a family as an essential unit in determining and influencing wellness and illness Appreciating the family dynamics in facing life events related to medicine	University-Family Partnership in Community Wellness Program (PuPUK model) evaluation
24	Larkins SL (45)	2013	Journal article	Australia	Developing and pilot testing a comprehensive evaluation framework to assess progress toward socially accountable health professions education	Mixed method
25	Chowdhury Z. (46)	2014	Book chapter	Bangladesh	Selecting case studies or 'stories' from selected schools; Defining community-based education	Case study
26	Bollela VR. (47)	2014	Book chapter	Brazil	Selecting case studies or 'stories' from selected schools; Defining community-based education	Case study
27	El-Metwally D (48)	2014	Book chapter	Egypt	Selecting case studies or 'stories' from selected schools; Defining community-based education	Case study
28	Sketch B. (49)	2014	book chapter	India	Selecting case studies or 'stories' from selected schools; Defining community-based education	Case study

29	Villiers M. (50)	2014	book chapter	South Africa	Selecting case studies or 'stories' from selected schools; Defining community-based education	Case study
30	Kikukawa, Makoto (51)	2014	Journal article	Japan	Investigating the outcomes of a community-based education program	Mixed method
31	Lee SWW (52)	2014	Journal article	UK, England	Evaluating the current provision and outcome of community-based education (CBE) in UK medical schools	Systematic review
32	Angélica Maria (53)	2015	Book chapter	Brasilia	Integrating primary healthcare with teaching-service-axis in the Faculty of Medical Sciences at Unicamp Curriculum	Case study
33	Renata Maria Zanardo (54)	2015	Book chapter	Brasilia	The Medical and Nursing Undergraduate Education in Primary Healthcare: 45 Years of Experience at Botucatu Medical School	Case study
34	Maria Katia Gomes (55)	2015	book chapter	Brasilia	The Experience of the Faculty of Medicine at the Federal University of Rio de Janeiro School of Medicine	Case study
35	Maria Neile Torres de (56)	2015	book chapter	Brasilia	The Experience at the Federal University of Ceará Medical School	Case study
36	Oscarina da Silva Damásio (57)	2015	book chapter	Brasilia	Blended Learning and Concept Map During a Primary Care Medicine Clerkship at the Medical School of Federal University of Juiz de Fora	Case study
37	Alessandra Vitorino (58)	2015	book chapter	Brasilia	Community-based Education: The Experience of the Goiás Federal University	case study
38	Marlene Rodrigues (59)	2015	book chapter	Brasilia	Community-based Education in the Medical School at the Maringá State University, Experiences and Challenges	Case study
39	Rosuita Fratari (60)	2015	book chapter	Brasilia	Health and Medical Education as Social Commitments at the Uberlândia Federal University	Case study
40	Daniela Chiesa (61)	2015	book chapter	Brasilia	The Community-based Education at the University of Fortaleza Medical School	Case study
41	Ana Claudia Camargo (62)	2015	book chapter	Brasilia	Service-learning-community integration in the Teaching of Primary Healthcare: Lessons and Challenges of the USP School of Medicine	Case study
42	Strasser R. (10)	2015	Journal article	Canada	Examples of the Implementation and Implications of Community-engaged Medical Education at Three Medical Schools	Case report
43	Holst, J. (63)	2015	Journal article	Germany	Ensuring Rural Medical Care, Including Innovative Teaching Approaches During Undergraduate Training	Educational program (qualitative designed)
44	Bannon A. (64)	2015	Journal article	UK	Describing and Evaluating the Initiative, the Personal Development Certificate (PDC): A 12-Week Community Development Program	Quantitative and qualitative design
45	Hosny, S. (23)	2015	Journal article	Egypt	Assessing the compliance of the Faculty of Medicine, Suez Canal University, to social accountability using the "Conceptualization, Production, Usability" (CPU) model	Qualitative design
46	Ellaway, R. (16)	2016	Journal article	Canada	Exploring and synthesizing the evidence on medical school-community relationships	Systematic review

47	Charles Boelen (19)	2016	Journal article	WHO, Geneva, Switzerland	Recognizing excellence in medical education and social obligation scale	Non stated
48	Amalba A. (65)	2016	Journal article	Ghana	Investigating students' perceived usefulness of COBES and its potential effect on their choice of career specialty and willingness to work in rural areas	Mixed-methods design
49	Arscott-Mills, T. (66)	2016	Journal article	Botswana	Investigating the impact of rural training on students' attitudes toward rural practice	Mixed-methods design
50	Kapanda, G. E. (67)	2016	Journal article	Tanzania	Assessing students' perceptions and attitudes toward rural practice after graduation	Quantitative study
51	Pokharel, P. K. (68)	2016	Journal article	Nepal	Describe the teaching district concept and its implementation	Narrative review
52	Strasser, R. (69)	2016	Journal article	Canada	Examples from Canadian and Australian education programs that provide the majority of clinical education in remote and rural settings	Case report
53	Siega-Sur J. L. (20)	2017	Journal article	Philippines	Describing the impact of socially accountable health professional education on graduates	Quantitative study
54	Cole, C. (70)	2018	Journal article	Cuba	Cuban Medical Education: 1959 to 2017	Review article
55	Woolley, T. (21)	2018	Journal article	Philippine	Describing differences between the practice locations of Philippines medical graduates from two 'socially accountable, community-engaged' health professional education programs	Quantitative study
56	Elyasa Elamin S. A. (71)	2018	Journal article	Gezira	Evaluating competencies and their interventions toward the community and evaluating the module from students' views	Quantitative study
57	Yoo J. E. (72)	2018	Journal article	Korea	Proposing learning objectives and an educational program for community-based medical education	Consensus workshop for curriculum development
58	Ohta, R. & Ryu Y. J. (73)	2019	Journal article	Japan	Examining students' perceptions of general medicine following community-based medical education in rural Japan	Mixed methods design
59	Ahmed, S. (74)	2019	Journal article	Bangladesh	Investigating medical students' perceptions of community-based learning experiences	Quantitative study
60	Choulagai B. P. (75)	2019	Journal article	Nepal	Assessing the organization and implementing community-based education in the Institute of Medicine	Qualitative design
61	Adefuye, A. (76)	2019	Journal article	South Africa	Investigating student's perceptions of their experience during community-based medical education training at Botshabelo District Hospital	Qualitative design
62	Lindsey Pope, (4)	2020	Journal article	UK	Evaluating sociocultural factors impeding the expansion of undergraduate medical education in general practice	Non stated
63	Massé, J. (9)	2020	Journal article	Canada	Identifying and understanding what medical trainees gain from their experience in community-based training	Qualitative study

64	Yahata, S. (77)	2020	Journal article	Japan	Investigating the long-term impact of community-based clinical training (CBCT) in Japan on current community healthcare (CH) practice	Quantitative study
65	Houbby N. (78)	2020	Journal article	UK	Reflecting on students' experiences after taking part in the community action product during their third year at medical schools	Case study
66	Marjadi B. (79)	2020	Journal article	Australia	Describing the Western Sydney University School of Medicine (WSUSoM) diversity education program, medicine in context pedagogy in teaching diverse social determinants of health to first clinical year medical students	Descriptive report (Curriculum design)
67	Amalba, A. (80)	2020	Journal article	Africa	The Role of Community-Based Education and Service (COBES) in Undergraduate Medical Education in Reducing the Mal-Distribution of Medical Doctors in Rural Areas in Africa	Systematic review
68	Ohta, R. (6)	2021	Journal article	Japan	Synthesizing the impact of the involvement of communities on the learning of medical trainees in community-based medical education	Systematic review
69	Alberti, P. (8)	2021	Journal article	USA	Why Academic Medicine Must Embrace Community Collaboration as Its Fourth Mission	Non stated
70	Mann-Jackson, L. (81)	2021	Journal article	USA	Addressing STI/HIV disparities and social determinants of health among young and transgender women of color in North Carolina, USA	Community-based participatory research
71	Guignona, M. (22)	2021	Journal article	Philippines	Describing the qualitative evidence of ADZU-SOM students and graduates having positive impacts on local health services and communities and the contextual factors associated with the school's socially accountable mission and curriculum that contribute to these impacts	Case study
72	Deepa Shah (7)	2022	Journal article	UK	Evaluating the Community Diagnosis Project	Quantitative and qualitative
73	O'Brien B. C. (82)	2022	Journal article	USA	Identifying and evaluating system-level outcomes of pre-clerkship medical students' engagement in health system improvement efforts	Case study
74	Northern Ontario School of Medicine (83)	-	Medical school cite	Canada	Reviewing the medical education curriculum	Non stated
75	Taibah University, College of Medicine (84)	-	Medical school cite	Saudi Arabia	The MBBS Program Student Guide (Reviewing the Medical Education Curriculum)	Non stated
76	Medical University of Khartoum (85)	-	Medical school cite	Sudan	Khartoum Community Medicine Department Curriculum	Non stated

Table 3. Distinctive Types of Community-related Medical Education

Community-related medical education	Presence percentage in the field of primary healthcare centers	Mission/Objective	Student's admission	Educational strategy	Student's assessment	Community involvement
Community-oriented medical education	Lower than 20%	Social responsibility	-	A combination of different methods/strategies	No involvement of community members	No involvement of community (community sensitization)
Community-based medical education	20% to 50%	Social responsiveness	A percentage of students from indigenous members	A combination of different methods/strategies	Limited activity of community members	Inactive and limited involvement
Community-engaged medical education	More than 50%	Social accountability	Direct role of community in the selection of indigenous members	Student-oriented, such as problem-solving, longitudinal, and spiral	Active role of community members	Active and wide-ranging involvement

Table 4. Examples of Community-related Medical Education

Community-oriented medical education					
Education focused		Research-oriented		Service-oriented	
Community visit		Education in the field of hospital or primary healthcare centers		Research in the field of hospitals or primary healthcare centers	
Taibah University in Saudi Arabia (early contact) (84)		Unnan and Shimane, University in Japan (6)		Kowbe University in Japan (77)	
Malaya University in Malaysia (before 2005) (26)		-		-	
Kabangsan University in Malaysia (26)		-		-	
Rural health in Magdeburg (Germany) (63)		Rural Health in Magdeburg (Germany) (63)		-	
University of Botswana, South Africa (66)		Kilimanjaro Christian Medical University College (67)		-	
Uttara Adhunik Medical College, Dhaka (UAMC) (74)		Uttara Adhunik Medical College, Dhaka (UAMC) (74)		Uttara Adhunik Medical College, Dhaka (UAMC) (74)	
-		-		Imperial College of London (78)	
Pakistan universities (27)		Queen Mary University of London (64)		-	
Iran University of Medical Education		Iran University of Medical Education		Iran University of Medical Education	
Community-based medical education					
Education focused		Service-oriented		Education focused	
Community contact		Education in rural hospitals or primary healthcare centers		Research in primary healthcare centers	
Mahatma Gandhi University of India (37)		-		Research in the community	
				Informing or advising the community	
				Cross-sectional health interventions	
				Indian Christian College (49)	
				Gonoshasthaya Kendra in Bngladesh (46)	
				-	

Washington University (40)		-	Gonoshasthaya Kendra in Bngladesh (46)		-
Koirala Institute of Health Sciences (43), Tribhuvan University of Nepal, Nepal (75)	Koirala Institute of Health Sciences (43), Tribhuvan University of Nepal, Nepal (75)	-	Koirala Institute of Health Sciences (43), Tribhuvan University of Nepal, Nepal (75)	Koirala Institute of Health Sciences (43), Tribhuvan University of Nepal, Nepal (75)	-
	Stellenbach University of South Africa (50)	-		Stellenbosch University, South Africa (50)	Kathmandu University, Nepal (39, 68)
Malaya University in Malaysia (after 2005) (26)			Malaya University in Malaysia (26)	Malaya University in Malaysia (26)	-
University of Sao Paulo, Brazil (47, 54)	University of Sao Paulo, Brazil (47, 54)	Aga Khan University of Pakistan (2)	Aga Khan University of Pakistan (2)	Aga Khan University of Pakistan (2)	Aga Khan University of Pakistan (2)
Indian Christian College (49)	Indian Christian College (49)	-	University of Geneva, Switzerland (44)	University of Geneva, Switzerland (44)	University of Geneva, Switzerland (44)
Kandra University of Bangladesh (2)	Kandra University of Bangladesh (2)	-		Dartmouth Medical School (29)	Dartmouth Medical School (29)
University of Geneva, Switzerland (44), University of Dayton, Ohio (31)	University of Geneva, Switzerland (44), University of Dayton, Ohio (31),	-		University of Dayton, Ohio (31)	University of Dayton, Ohio (31)
Community-based medical education					
Education focused			Service-oriented	Education focused	
John Hopkins School of America (41)	John Hopkins School of America (41)	-	Morehouse School of Medicine (30)	Morehouse School of Medicine (30)	Morehouse School of Medicine (30)
-	-	-	-		University of Sao Paulo, Brazil (47, 54)
Community-engaged medical education					
Education focused		Research-oriented		Service-oriented	
Community Partnership	Education in primary healthcare centers and rural hospital	Participatory research in the community		Community empowerment	Longitudinal health interventions
Northern Ontario School of Medicine (69, 83)	Northern Ontario School of Medicine (69, 83)				Northern Ontario School of Medicine (69, 83)
Ateneo de Zamboanga University School of Medicine (Philippines) (10, 20, 21)	Ateneo de Zamboanga University School of Medicine (Philippines) (10, 20, 21)				Ateneo de Zamboanga University School of Medicine (Philippines) (10, 20, 21)

Flinders Australia (10)	Flinders Australia (10), University of Gezira (Sudan) (71)	University of Gezira (Sudan) (71)	Flinders Australia (10)	Flinders Australia (10)
Sabah University Malaysia (15)	Sabah University Malaysia (15)	North Carolina, USA (81)	Sabah University Malaysia (15)	Sabah University Malaysia (15)
Western Sydney University School of Medicine (WSUSoM) (79)	Western Sydney University School of Medicine (WSUSoM) (79)			
University of California, San Francisco School of Medicine (82)	University of California, San Francisco, School of Medicine (82)		University of California, San Francisco, School of Medicine (82)	University of California, San Francisco, School of Medicine (82)

A Novel Questionnaire to Assess the Knowledge, Attitude, and Practice of Medical Professionals Regarding Participation in Scientific Programs

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Abstract

Background: Though there is an increase in the number of scientific programs, the quality of these sessions is not always optimal.

Objectives: Our objective was to assess the knowledge, attitude, and practice of medical fraternity with regard to participation in scientific programs.

Methods: A total of 103 faculty members and postgraduates from all specialties of Sri Venkateshwaraa Medical College Hospital and Research Centre, Puducherry, India, who attended at least one scientific program (conferences, workshops, symposiums, panel discussions, or CMEs) in the past one year, were included. This was a cross-sectional questionnaire-based study conducted over a period of three months in 2019. The content validity index (CVI) was computed to ascertain the validity of the questionnaire. Principal component analysis (PCA) followed by the calculation of Cronbach's alpha was conducted to ascertain the reliability of the questionnaire. The self-developed and validated questionnaire was distributed among respondents, and necessary filling out instructions were elaborated to them.

Results: Out of 85 participants, 96.5% and 74% responded correctly to the definitions of workshop (n = 82) and conference (n = 63), respectively. The CVIs of individual questionnaire items were higher than 75%, and Cronbach's alpha of the questionnaire was obtained as 0.60. The mean knowledge score was 3.14 ± 1.3 , and demographic characteristics were not found to influence the knowledge score ($p > 0.05$). The 'expertise of resource persons' and 'necessity of the topic' were the major factors determining the tendency for participation in scientific programs, as agreed by 81.2% and 80% of the respondents, respectively ($p < 0.001$). Out of 83% of the respondents who were satisfied with their participation in the last scientific program they attended, major reasons for satisfaction were 'scientific content' (63%) and 'resource persons, speakers, or trainers' (63%).

Conclusion: The results of this study can be insightful to organizing bodies for better understanding the prerequisites of conducting any scientific session.

Keywords: Surveys and Questionnaires; Faculty; Health Knowledge, Attitudes, Practice; Education, Medical; Tertiary Healthcare

Background

A variety of scientific programs are conducted in the context of medical fields, from conferences, workshops, symposiums, seminars, and panel discussions to continued medical education (CME). Each program is unique in its way of organization and execution. The objective of individual programs may also vary even if the topic is the same (1). With rapid advances in medical sciences, there is a need to update one's knowledge and

skills instantaneously. Certainly, scientific programs have mushroomed to far greater numbers than before, supporting the aforementioned notion.

Since 2011, as noted in the 'Code of Medical Ethics Regulations', the Medical Council of India (MCI) has entrusted every doctor to obtain a minimum of 30 hours of CME credit points in a 5-year period to ensure the maintenance of good medical practice (2, 3). Moreover, some State Medical Councils have also made it

mandatory to acquire stipulated scientific program-related credit hours for the renewal (re-licensure for medical practice) of medical registration (4, 5). Postgraduates in medicine are also supposed to perform paper presentations as a part of partial fulfillment for graduation, making participation in these academic programs particularly important to them (6).

Outside India, the same credit point (hours)-based system is followed even more rigorously, particularly for the revalidation or recertification of medical practitioners (7). Despite an increase in the number of scientific programs held regularly, it is sometimes felt that the quality of these scientific programs is not up to expectations. Most often, participants are not fully satisfied with the scientific program in one way or another (2). The call for predatory scientific meetings is also increasing in number throughout the globe, particularly targeting young academicians from developing nations. These fraudulent conventions are organized by exploitative and non-qualified groups for revenue instead of scientific purposes (8, 9).

Hence, we here aimed to evaluate the knowledge, attitude, and practice of faculty members and medical postgraduates with regard to participation in scientific programs in a tertiary care teaching institute. The knowledge, attitude, and practice, or in short 'KAP', studies aim to explore the awareness, concerns, and actions of a particular community (here, healthcare professionals) towards a particular subject of interest (10).

To the best of our knowledge, so far, no similar studies have engaged in gauging the understanding, beliefs, and behaviors of medical professionals toward attending scientific programs.

Objectives

Our objective was to assess the knowledge, attitude, and practice of medical professionals with regard to participation in scientific programs.

Methods

Study Design, Setting, and Subjects: This cross-sectional questionnaire-based study was conducted in Sri Venkateshwara Medical College Hospital and Research Centre (SVMCH & RC), Puducherry, India (a tertiary care teaching hospital).

Faculty members and postgraduates, from all specialties, who attended at least one scientific program in the past year, were eligible. All cadres of faculty members from professors, associate professors, assistant

professors, and senior residents to tutors were eligible to participate in the study. Scientific programs, under the purview of this study, comprised conferences, workshops, symposiums, panel discussions, and CMEs conducted inside or outside of our institute.

Faculty members and postgraduates who attended only online training programs, certificate courses, and routine intradepartmental activities like journal clubs, subject review presentations, and debates were excluded from the study.

Sample Size: The sample size was calculated based on the below formula designed for estimating a percentage or proportion in a finite population:

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 (N - 1) + z^2 \cdot p \cdot q}$$

Where $z = 1.96$ (for 95%) [standard deviation], $p = 50\%$ [sample proportion], $q = 50\%$ [i.e., $(1 - p)$], $N = 266$ (total number of faculty members and postgraduates [size of the population], and $e = 10\%$ [acceptable error; conventionally considered as 10%].

Hence, with a margin of error of 10%, a confidence level of 95%, a population size of 266, and a response distribution of 50%, the minimum recommended sample size for the survey would be around 80 [considering a drop-out rate of 10%].

Study Procedure

The principles of the Declaration of Helsinki following good clinical practice were strictly adhered to during the entire course of the study.

A non-random convenience sampling technique was adopted. Eligible faculty members and postgraduates were explained about the details of the study, and written informed consent was obtained from them. A pre-validated questionnaire was distributed among the participants, and necessary instructions were elaborated to them on how to complete the questionnaire. On average, 10 to 15 minutes were given to fill in the questionnaire. Completed questionnaires were recollected in a closed envelope to maintain anonymity.

The questionnaire contained 15 items, with 5 items in the 'knowledge' section, 6 items in the 'attitude' section, and 4 items in the 'practice' section (Appendix). The 'knowledge' section composed of partially categorized questions; the 'attitude' section included Likert scale-type questions, and there were both closed-ended and partially categorized questions in the 'practice' section. The questionnaire also addressed demographic details in the beginning; however, there was no enquiring about the name of the respondent.

Questionnaire Development: As there were no similar studies, the entire questionnaire was self-developed and then validated. A panel of experts (n = 5), comprising senior faculty members in our institute, meticulously reviewed the questionnaire. Each expert independently rated the relevance of each item using a 4-point Likert scale (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = completely relevant). Ratings '3' and '4' were together considered as a "favorable" response to the item, so the particular question was considered relevant. Similarly, ratings of '1' and '2' were together considered an "unfavorable" response, so the question was regarded as irrelevant. All 15 items were retained without major modifications as the content validity index (CVI) of all individual items was fairly above the cut-off (Table 1).

The validated 15-item questionnaire was then submitted to the Copyright Office, Government of India, and the copyright was granted with the registration number L-79084/2018.

Questionnaire Items: The questionnaire items 1 to 5 were framed to test knowledge about the definition of various scientific programs. Items 1, 2, 3, 4, and 5 inquired about the definition of workshop, conference, CME, symposium, and panel discussion, respectively. A score of '1' or '0' was awarded for a 'correct' or 'wrong' response, respectively. The cumulative score was calculated by adding the individual scores of each questionnaire item. Hence, the total score of each respondent could range from 5 (maximum; all answers were correct) to 0 (minimum; no answer was correct).

There were six questionnaire items (6 to 11) under the section of attitude towards participation in scientific programs. The 'necessity of the topic', 'reputation of the organizing body', 'expertise of the resource person', 'registration fees', 'distance from the workplace', and 'length of the scientific program' were described in items 6, 7, 8, 9, 10, and 11, respectively. The items were scored on a 5-point Likert scale with options ranging from 'strongly agree', 'moderately agree', 'neutral', 'moderately disagree', to 'strongly disagree'. Items 6, 9, and 10 were reverse coded. Under the practice section, the first two items (items 12 and 13) addressed the frequency of participation in scientific programs. Item 12 was about participation in conferences, symposiums, or CMEs, and item 13 was about participation in workshops or training programs. Item 14 had two parts (A and B). Item 14A questioned satisfaction with the last scientific program on a 5-point Likert scale ranging from 'completely satisfied', 'partially satisfied', 'neutral',

'partially dissatisfied', to 'completely dissatisfied', and item 14B addressed the reason(s) for 'satisfaction' or 'dissatisfaction', where the respondent was allowed to select multiple options. The last questionnaire item (i.e., item 15) was a general question about the reason(s) for attending scientific programs, in which selecting multiple options was permissible (Table 2).

Statistical Analysis: Data were expressed as mean \pm standard deviation for continuous variables and percentage (%) for categorical variables. The chi-square goodness-of-fit test was used for the analysis of categorical variables. Mann-Whitney U test was used for comparing continuous non-parametric variables and chi-square or Fisher's exact test for comparing categorical variables. Principal component analysis followed by reliability analysis was undertaken to check for the internal consistency of the questionnaire. The data were recorded and analyzed using Microsoft Excel, Office 2010 (Microsoft Corporation, Redmond, WA, USA), GraphPad InStat, version 3.06 (GraphPad Software, San Diego, CA, USA), and SPSS, version 20.0 (SPSS Inc., Chicago, IL, USA).

Results

The questionnaires were distributed among 103 faculty members and postgraduates enrolled based on eligibility criteria. Out of this, 85 questionnaires were included for final analysis (ten questionnaires had incomplete data; five persons declined to participate, and another three failed to return the forms).

The respondents were adequately representative of all departments, namely, Anatomy, Physiology, and Biochemistry (Pre-Clinical Departments); Pharmacology, Pathology, Microbiology, Forensic Medicine, and Community Medicine (Para-Clinical Departments), and Ophthalmology, Otorhinolaryngology, General Medicine, General Surgery, Obstetrics and Gynecology, Pediatrics, Orthopedics, Anesthesiology, Pulmonary Medicine, and Radiodiagnosis (clinical departments). Furthermore, 54.1% of the respondents were from the college (pre- and para-clinical departments), and the remaining 45.9% of the respondents were from the hospital side (clinical departments).

Most of the respondents were assistant professors (37.7%), followed by postgraduates (24.7%), professors (12.9%), associate professors (9.4%), senior residents (9.4%), and tutors (5.9%). Overall, 62.4% of the respondents were male, and most of them had an age around 34 years old. Excluding postgraduates, the

respondents possessed an average of 6.4 years of teaching experience (Table 3).

Knowledge

Only 24% of the respondents correctly answered all definitions of scientific programs (the total knowledge score = 5) [Q. 1 to Q. 5]. The total knowledge score was less than 3 in 35% of the participants. The mean knowledge score was 3.14 ± 1.3 .

Out of 85 respondents, 82 (96.5%) identified the definition of workshop correctly. The definition of conference was chosen correctly by nearly 74% of the respondents. Around 50% of the respondents selected the correct option denoting the definition of CME and symposium. However, only 36.5% of the respondents were aware of the definition of panel discussion (Figure 1).

Collectively, around 4% of the knowledge-related items remained either unanswered or the respondents were unsure of the exact answer.

The respondents were categorized based on their total knowledge scores, i.e., those with a high knowledge score (≥ 3) and those with a low knowledge score (< 3), and the association with demographic characteristics was studied. None of the demographic parameters, namely, age, gender, educational qualification, academic position (designation), department, experience, and the number of scientific programs attended were found to be related to the knowledge score ($p > 0.05$) (Table 4).

Attitude

Overall, 81.2% and 80% of the respondents agreed (including both strong and moderate agreement) that 'expertise of the resource persons' and 'necessity of the topic' were, respectively, among the major factors determining participation in scientific programs. Similarly, 'agreement' was expressed for other factors like 'reputation of the organizing body', 'distance from the workplace', 'length of the program', and 'registration fees' with frequencies of 63.5%, 63.5%, 51.8%, and 47.1%, respectively. The chi-square goodness-of-fit test for all categories was statistically significant with $p < 0.001$ (Figure 2) [Q. 6 to Q. 11].

Practice

A total of 47% of the respondents attended conferences, symposiums, or CMEs once every three months or more often whereas those who were attending workshops or training programs as frequently as above constituted only 12% of the participants. The chi-square goodness-of-fit test for both categories was statistically significant with $p < 0.001$ [Q. 12 and Q. 13].

Also, 83% of the respondents were either completely or partially satisfied with their participation in the last scientific program they attended, and only 4% expressed dissatisfaction. Eliminating this 4% and the other 13% of the respondents who had selected the neutral option, 63% of the responses ($n = 70$) expressed their reasons for 'satisfaction' as 'scientific content' and 'resource persons, speakers, or trainers'.

'Food and accommodation' and 'ambience' were reasons for satisfaction in 21% and 17% of the participants, respectively (Figure 3) [Q. 14].

Most (93%) of the respondents vouched for the option 'improvement of scientific knowledge or skills – professional development' as the major driving force for their participation in scientific programs. 'Establishing more professional contacts' (59%) and 'acquiring credit points for academic promotion' (49%) were the next important motivating factors that encouraged the respondents to attend scientific programs (Figure 4) [Q. 15].

Finally, the respondents were categorized based on the knowledge score, and a bivariate analysis was performed to assess the influence of knowledge on attitude and practice. The results showed no association between the knowledge score and attitude or practice toward participation in scientific programs ($p > 0.05$). Only the 'expertise of the resource person' seemed to be significantly associated with knowledge ($p = 0.011$); around 89% of respondents with higher knowledge (scores ≥ 3) agreed upon the importance of 'the expertise of the resource person' in their decision to attend scientific programs compared to only 66% of respondents with lower knowledge (scores < 3) (Table 5).

Principal Component Analysis and Reliability Analysis

Multiple principal component analysis (PCA) was performed to assess the dimensionality of the variables (items) studied. The initial PCA was run with nine items, i.e., from item 6 to item 14A. The items related to the 'knowledge' section and items 14B and 15 were excluded from analysis because 'knowledge' items had a single best option, and items 14B and 15 had multiple responses. The reverse-coded 'attitude' items (namely, items 6, 9, and 10) were re-coded appropriately before the analysis. The final PCA yielded four components with Eigen values > 1 (the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.492, and Bartlett's test of sphericity was statistically significant). These four components included five variables (items) with individual factor loadings higher than 0.4 (i.e., items 7,

8, 11, 12, and 13 with factor loadings of 0.719, 0.632, 0.464, 0.442, and 0.561, respectively). Hence, based on the results of PCA, the above five items were subjected to reliability analysis, retrieving Cronbach's alpha (or coefficient alpha) of 0.60.

Discussion

Overall, only 48% of the study participants knew the definition of CME, symposium, and panel discussion, excluding 4% of the questionnaire items that were unknown or left blank by the respondents. Hence, most of the respondents had a wrong presumption about the definition of scientific programs, particularly, programs conducted less frequently like symposiums and panel discussions compared to those held more commonly such as conferences and workshops. Nearly 85% of the respondents were aware of the definitions of workshop and conference. The higher rate of wrong responses for the definition of panel discussion could be due to lack of a concrete option for the same; rather, the respondents needed to fill-in this response by choosing the last blank option.

It was observed that more experienced respondents (around 7 years) had a higher knowledge score (≥ 3) compared to the less experienced respondents (around 5 years), though this difference was not statistically significant.

The dismal understanding of the respondents drives home the message that the medical professionals need to be educated about various kinds of scientific programs that are being conducted. Occasionally, the organizers of scientific programs are to be blamed as they hold programs under the wrong label – like designating a symposium or panel discussion as a CME. The justification for such errors in the description could be the fine line of demarcation that separates these scientific programs. Hence, the onus lies with medical education departments to enlighten both organizers and participants about various types of scientific programs.

Indirectly, the 'attitude' dimension measured major contributors to participation in a scientific program from delegates' perspectives. The major motivating factors contributing to participation in scientific programs were found to be the 'need for the topic' and the 'expertise of the resource person' based on the responses of more than 80% of the respondents. On the other hand, the 'registration fees' and 'duration' of the scientific program played a lesser role, as mentioned by around 50% of the respondents. An online survey by Lang *et al.* (11) revealed similar results wherein 90% of

the faculty members who participated in the study noted the following three factors as the most important criteria for choosing to participate in a conference, namely, 'topics being in the areas of interest', 'well-known, respected plenary speakers', and 'likelihood for cutting-edge research being presented'; while relatively fewer respondents considered the 'location', 'time', and 'cost' of the conference important elements.

The relative reluctance of academics to attend workshops or training programs is detrimental as these programs can drastically upscale their hands-on skills and knowledge on relevant compared to more didactic and less-participant-centered conferences, symposiums, or CMEs (12).

Based on our results, to boost the satisfaction of attendees, organizers need to concentrate more on the scientific content and resource persons than on the food, accommodation, or ambience. Similarly, the key drivers luring the scientific community to attend scientific programs could be the improvement of scientific knowledge or skills and the development of professional contacts, as well as gathering credit points for promotion.

The responsibility of program organizers is to maintain the academic robustness of the scientific program they intend to conduct. Rigorous steps need to be followed when conducting these programs from selecting the theme or topic, deciding on the speakers or resource persons, choosing appropriate dates and venues, preparing brochures, inviting delegates, and finally, organizing the event methodologically (13, 14). Post-program evaluation of academic sessions, particularly with regard to CMEs, is necessary to ascertain the effectiveness of the program (15).

The strikingly lower positive responses to non-academic options like food, accommodation, ambience, places, or meeting friends and relatives may not be a true reflection of the practice. Basically, KAP questionnaire studies capture the declarative opinions of respondents and as such substantial gaps may exist between what is said and what is done, which is a known limitation of any KAP study.

Cronbach's alpha of the present instrument was obtained as 0.60, and this was justifiable as the current study was rather an exploratory one with a relatively small sample size (16, 17).

Like innovations in medical science research, there is a need for more novel strategies to conduct scientific programs to break the monotony, and let the participant to be more engaged with the subject (18). Video- or teleconferences, webinars, podcasts, webcasting, and other

repurposed meetings conducted through interactive social media are some of the potential alternatives. Moreover, the focus should be on the quality of academic sessions rather than on their frequency (19, 20). Sometimes, a combination of both conventional didactic and more interactive programs is required to increase the effectiveness of educational meetings (21).

Some limitations of this study included the relatively small sample size and the lack of representativeness of the study population of all medical professionals in other parts of India and elsewhere outside the country.

Conclusion

Our respondents were better aware of the definitions of conference and workshop than other types of scientific programs. The 'necessity of the topic' and the 'expertise of resource persons' were the two foremost determining factors for participation in a scientific program. The participants tend to attend conferences, symposiums, or CMEs more than workshops or training programs. The major elements increasing satisfaction with programs were 'scientific content' and 'resource persons, speakers, or trainers' as opined by those who were satisfied with their last attendance to a scientific program. Likewise, the major driving force for participation in a scientific meeting was the necessity for the improvement of scientific knowledge or skills and professional development.

This questionnaire-based survey can offer a useful tool to explore the needs of medical healthcare professionals attending a scientific program. The results of this study can be used by organizing bodies to identify the prerequisites of conducting a scientific session.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The study was approved by the Scientific Research Committee (SRC) [SVMC/SRC/2018/10/CTR341] and the Institute Ethics Committee – Human Studies (IEC) [SVMCH/IEC/2018-Oct/02].

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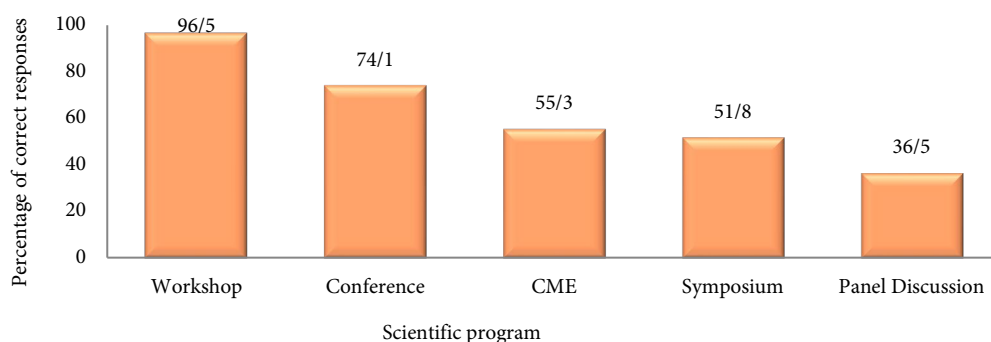


Figure 1. Knowledge about the definition of scientific programs (N = 85)

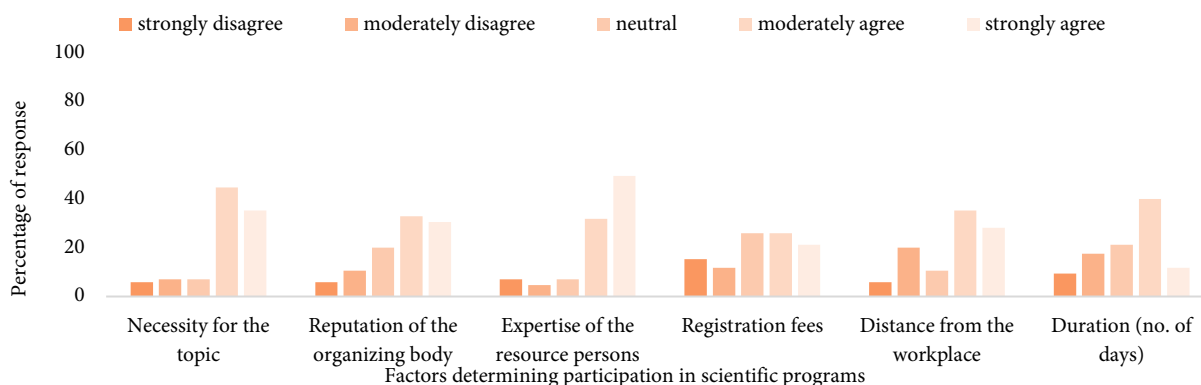


Figure 2. Factors determining participation in scientific programs (N = 85)

*p < 0.001 for all categories; p < 0.05 was considered statistically significant; chi-square goodness-of-fit test was performed.

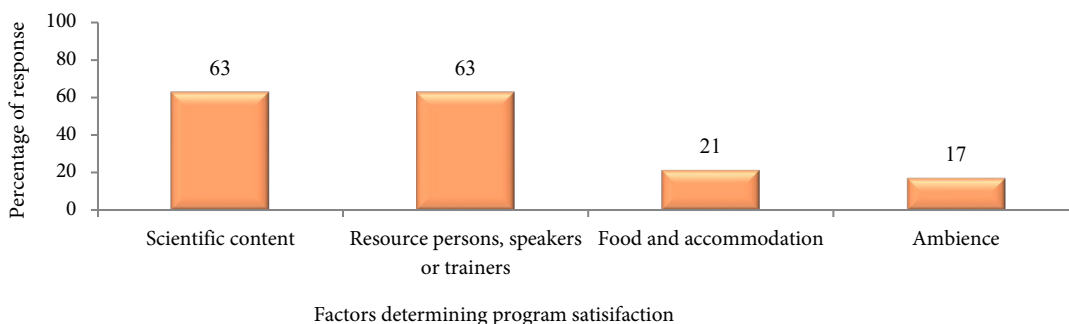


Figure 3. Factors contributing to satisfaction with participation in a scientific program (N = 70)

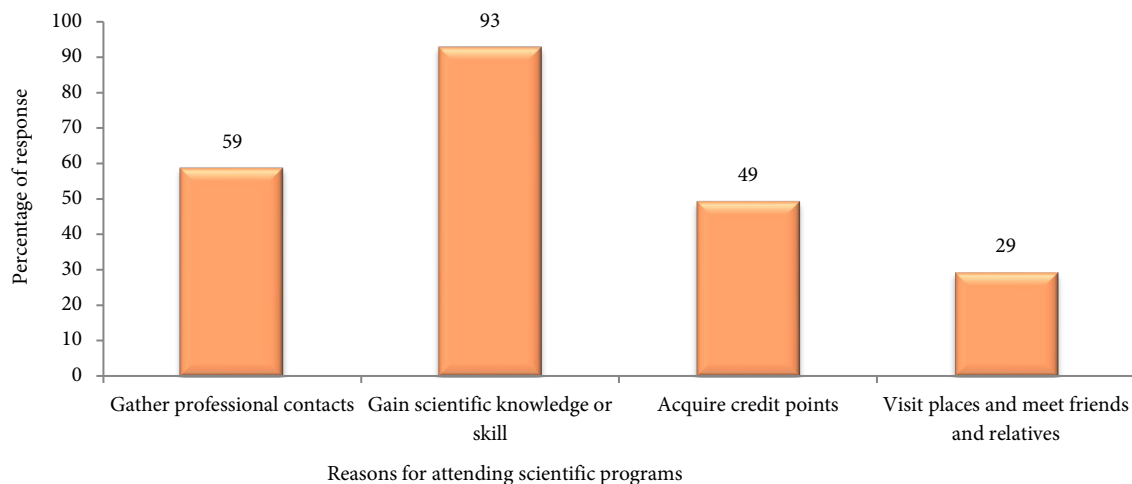


Figure 4. Reasons for attending scientific programs (N = 85). The options were not mutually exclusive and thus, the selection of multiple options was permissible.

Table 1. Content validity index of individual questionnaire items

Questionnaire item	Questionnaire description	Content Validity Index (CVI), %
1	Definition of “Workshop”	100
2	Definition of “Conference”	100
3	Definition of “CME”	75
4	Definition of “Symposium”	100
5	Definition of “Panel discussion”	75
6	Necessity of the topic	100
7	Reputation of the organizing body	100
8	Expertise of resource persons	100
9	Registration fees	75
10	Distance from the workplace	100
11	Duration of the scientific program	100
12	Participation in conferences, symposiums, or CME	75
13	Participation in workshops or training programs	75
14 A	Degree of satisfaction with reference to the last scientific program	100
14 B	Reason(s) for ‘satisfaction’ or ‘dissatisfaction’ regarding the above question (14 A)	100
15	Reason(s) for attending scientific programs	100

Table 2. Questionnaire items, description, domain, and evaluation

Questionnaire item	Item description	Domain	Evaluation
1	Definition of “Workshop”	Knowledge	Score of 5 (maximum) to 0 (minimum)
2	Definition of “Conference”		
3	Definition of “CME”		
4	Definition of “Symposium”		
5	Definition of “Panel discussion”		
6	Necessity of the topic	Attitude	Likert scale Strongly agree Moderately agree Neutral Moderately disagree Strongly agree
7	Reputation of the organizing body		
8	Expertise of the resource person		
9	Registration fees		
10	Distance from the workplace		
11	Duration of the scientific program		

12	Participation in conference, symposium, or CME	Practice	Choose the best option
13	Participation in workshops or training programs		Choose the best option
14 A	Degree of satisfaction with reference to the last scientific program		Likert scale Completely satisfied Partially satisfied Neutral Partially dissatisfied Completely dissatisfied
14 B	Reason(s) for 'satisfaction' or 'dissatisfaction' for the above question (14 A)		More than one option can be selected
15	Reason(s) for attending scientific programs		More than one option can be selected

Table 3. Demographic characteristics of respondents (N = 85)

Parameters	Values [mean \pm SD; n (%)]
Age, years	33.8 \pm 8.4
Gender, n (%)	
Males	53 (62.4)
Females	32 (37.6)
Highest educational qualification, n (%)	
M.D./ M.S.	52 (61.2)
M.B.B.S.	21 (24.7)
D.N.B./ Diplomas	5 (5.9)
Ph.D./ M.Sc.	7 (8.2)
Academic position, n (%)	
Professor	11 (12.9)
Associate Professor	8 (9.4)
Assistant Professor	32 (37.7)
Senior Resident	8 (9.4)
Tutor	5 (5.9)
Post-graduate	21 (24.7)
Department, n (%)	
Pre-Clinical	17 (20)
Para-Clinical	29 (34.1)
Clinical	39 (45.9)
Years of experience (post-graduation)	6.39 \pm 6.3
No. of scientific programs attended in the last year, Median (Range)	3 (1 to 21)

Table 4. Demographic characteristics of respondents categorized based on the knowledge score (N = 85)

Parameters	Knowledge Score < 3 (n = 30) [mean \pm SD; n (%)]	Knowledge Score \geq 3 (n = 55) [mean \pm SD; n (%)]	p
Age, years	33.2 \pm 7.3	34.1 \pm 8.9	0.890
Males, n (%)	20 (66.7)	33 (60)	0.642
Highest educational qualification, n (%)			0.304
M.D./ M.S.	19 (63.3)	33 (60)	
M.B.B.S.	5 (16.7)	16 (29.1)	
D.N.B./ Diplomas	3 (10)	2 (3.6)	
Ph.D./ M.Sc.	3 (10)	4 (7.3)	
Academic position, n (%)			0.314
Professor	3 (10)	8 (14.5)	
Associate Professor	2 (6.7)	6 (10.9)	

Assistant Professor	14 (46.7)	18 (32.7)	
Senior Resident	4 (13.2)	4 (7.3)	
Tutor	2 (6.7)	3 (5.5)	
Post-graduate	5 (16.7)	16 (29.1)	
Department, n (%)			0.804
Pre-Clinical	5 (16.7)	12 (21.8)	
Para-Clinical	10 (33.3)	19 (34.6)	
Clinical	15 (50)	24 (43.6)	
Years of experience (after post-graduation)	4.94 ± 5.1	7.32 ± 6.8	0.092
No. of scientific programs attended in the last year, Median (Range)	3 (1 to 21)	3 (1 to 12)	> 0.999

Table 5. Attitude and practice categorized based on the knowledge score (N = 85)

Parameters	Knowledge Score < 3 (n = 30) [mean ± SD; n (%)]	Knowledge Score ≥ 3 (n = 55) [mean ± SD; n (%)]	p
Factors determining participation in scientific programs, n (%)			
Necessity of the topic	23 (76.7)	45 (81.8)	0.570
Reputation of the organizing body	15 (50)	39 (63.6)	0.135
Expertise of the resource person	20 (66.7)	49 (89.1)	0.011
Registration fees	14 (46.7)	26 (47.3)	0.762
Distance from the workplace	17 (56.7)	37 (67.3)	0.332
Duration (days)	15 (50)	29 (52.7)	0.936
Frequency of attending scientific programs, n (%)			
Conference, symposium, or CME			0.939
Once a month or more often	3 (10)	5 (9.1)	
Once every two months	4 (13.3)	6 (10.9)	
Once every three months	7 (23.3)	15 (27.3)	
Once every six months	12 (40)	20 (36.4)	
Once a year or less often	4 (13.3)	9 (16.4)	
Workshop or training programs			0.709
Once a month or more often	0 (0)	0 (0)	
Once every two months	1 (3.3)	2 (3.6)	
Once every three months	3 (10)	4 (7.3)	
Once every six months	13 (43.3)	20 (36.4)	
Once a year or less often	13 (43.3)	29 (52.7)	
Factors contributing to satisfaction with scientific programs, n (%)			-
Scientific content	16 (61.5)	28 (63.6)	
Resource persons, speakers, or trainers	18 (69.2)	26 (59.1)	
Food and accommodation	4 (15.4)	11 (25)	
Ambience	3 (11.5)	9 (20.4)	
Reasons for attending scientific programs			-
Establishing professional contacts	17 (56.7)	33 (60)	
Gaining scientific knowledge or skills	27 (90)	52 (94.5)	
Acquiring credit points	14 (46.7)	28 (50.1)	
Visiting places and meeting friends and relatives	6 (20)	19 (34.5)	

Appendix

ID:

Date:

Assessment of knowledge, attitude and practices among medical professionals regarding participation in scientific programs – a questionnaire-based study in a tertiary care teaching institute

Demographic details

- Age (in years)/ Gender : /
- Educational qualification :
- Designation :
- Department :
- Years of experience (After post-graduation) :
- No. of scientific programs attended in the last one year:

[For selecting an option, please ENCIRCLE the particular Roman numeral]

Knowledge

1. 'It is a form of academic instruction, either at a university or offered by a commercial or professional organization. It emphasizes 'hands-on-practice' or laboratory work. The lab work is designed to reinforce, imprint and bring forward an immediate functioning dimension to the participant's eye and hands by implementing and practicing the actual concept or technique that was taught through the lecture and demonstration process.'

The above description best relates to a...

- I. Conference
- II. Symposium
- III. Workshop
- IV. CME
- V. Not sure
- VI. Others, _____ (Please, specify)

2. 'It is a formal meeting which involves discussion, problem-solving, exchange of information and consultation among the delegates. It is usually held on a regional, state or national level. It ranges from once half-day to one week in length and may cover a single topic in depth or be broadly comprehensive.'

The above description best relates to a...

- I. Conference
- II. Symposium
- III. Workshop
- IV. CME
- V. Not sure
- VI. Others, _____ (Please, specify)

3. 'It consists of educational activities which serve to maintain, develop, or increase the knowledge, skills and professional performance and relationships that a physician uses to provide services for patients, the public, or the profession.'

The above description best relates to a...

- I. Conference
- II. Symposium
- III. Workshop
- IV. CME
- V. Not sure
- VI. Others, _____ (Please, specify)

4. 'It is a series of speeches on a selected subject usually completed in a single day. Each person or expert presents an aspect of the subject briefly. In the end, the audience may raise questions. The chairman makes a comprehensive summary at the end of the entire session.'

The above description best relates to a...

- I. Conference
- II. Symposium
- III. Workshop
- IV. CME
- V. Not sure

VI. Others, _____ (Please, specify)

5. 'Four to eight persons who are qualified to talk about the topic sit and discuss a given problem or the topic, in front of a large group or audience. The panel is composed of a chairman or moderator and about four to eight speakers. The chairman opens the meeting, welcomes the group and introduces the speakers on the panel. He introduces the topic briefly and invites the panel to present their points of view. After the main aspects of the subject are explored by the panel speakers, the audience is invited to take part. The discussion should be spontaneous and natural.'

The above description best relates to a...

- I. Conference
- II. Symposium
- III. Workshop
- IV. CME
- V. Not sure
- VI. Others, _____ (Please, specify)

Attitude

6. Do you feel that scientific programs are attended based on the need for the topic concerned?
- I. strongly disagree
 - II. moderately disagree
 - III. neutral
 - IV. moderately agree
 - V. strongly agree
7. Do you feel that scientific programs are attended based on the reputation of the organizing/ conducting body?
- I. strongly agree
 - II. moderately agree
 - III. neutral
 - IV. moderately disagree
 - V. strongly disagree
8. Do you feel that scientific programs are attended based on the expertise of the resource persons, trainers or speakers?
- I. strongly agree
 - II. moderately agree
 - III. neutral
 - IV. moderately disagree
 - V. strongly disagree
9. Do you feel that the 'registration fees' for a scientific program is a major determining factor for participation?
- I. strongly disagree
 - II. moderately disagree
 - III. neutral
 - IV. moderately agree
 - V. strongly agree
10. Do you feel that the 'distance from the workplace' for a scientific program is a major determining factor for participation?
- I. strongly disagree
 - II. moderately disagree
 - III. neutral
 - IV. moderately agree
 - V. strongly agree
11. Do you feel that the 'duration (no. of days)' of a scientific program is a major determining factor for participation?
- I. strongly agree
 - II. moderately agree
 - III. neutral
 - IV. moderately disagree
 - V. strongly disagree

Practice

12. How often you attend a conference, symposium or CME?
- I. Once a month or more often
 - II. Once every two months
 - III. Once every three months
 - IV. Once every six months
 - V. Once a year or less often
13. How often you attend a workshop or training program?
- I. Once a month or more often
 - II. Once every two months
 - III. Once every three months
 - IV. Once every six months
 - V. Once a year or less often
14. A. How much were you satisfied with the last scientific program you attended?
(Please, specify the type of scientific program _____)
- I. completely satisfied
 - II. partially satisfied
 - III. neutral
 - IV. partially dissatisfied
 - V. completely dissatisfied
14. B. *What was the reason for your 'satisfaction' or 'dissatisfaction'?
- [*You may ENCIRCLE more than one option. You need NOT answer, if you had selected the option 'III. neutral' for 14. A.]
- I. Scientific content
 - II. Resource persons, speakers or trainers
 - III. Food and accommodation
 - IV. Ambience
 - V. Others, _____ (Please, specify)
15. *Scientific programs are generally attended for the following purpose(s),
[*You may ENCIRCLE more than one option]
- I. To develop more professional contacts among peers
 - II. Advancement of scientific knowledge or skill professional development
 - III. To acquire credit points – so as to aid in promotion
 - IV. As a chance to visit places and meet friends and relatives
 - V. Others, _____ (Please, specify)

Validation of the Persian Version of Dental Students' Attitude toward Underserved Populations Questionnaire

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Abstract

Background: Assessing dental students' attitudes toward providing services to disadvantaged populations is essential for improving community-based training programs. Up to now, few scales have been developed to measure dental students' attitudes about deprived groups, among which the "Dental Students' Attitudes Toward Underserved populations instrument" (DSATU) is a reliable questionnaire.

Objectives: This study aimed to assess and confirm the validity and reliability of Persian version of the DSATU questionnaire.

Methods: In this validation study, translation and cultural adaptation were made by translation and back-translation method. A panel of experts assessed the face and content validity qualitatively. The content validity was assessed using a quantitative approach (which included the Content Validity Ratio (CVR) and the Content Validity Index (CVI). The item's impact score was evaluated by dental students. The test-retest method and Cronbach's alpha were used to determine the reliability.

Results: The questionnaire was revised and modified based on the validation results. Regarding CVR, two questions were excluded. Moreover, according to CVI and impact score results, eight questions were modified and corrected. Total cronbach's alpha coefficient (= 0.831) and intraclass correlation coefficient (0.83) were acceptable. The Pearson and Spearman's rank correlation coefficient indicated that the reliability was appropriate.

Conclusion: The introduced Persian version of the DSATU questionnaire is a culturally appropriate, valid, and reliable instrument for Persian researchers who intend to evaluate the attitude of dental students toward underserved populations. Moreover, it can be used to evaluate the effectiveness of community-based training programs in longitudinal studies.

Keywords: Dental student; Attitudes; Underserved Populations; Translation; Validation; Questionnaire

Background

Oral health is one of the most critical aspects of overall health. Oral diseases are widespread and adversely influence the quality of life. The distribution of oral diseases in the population is affected by socioeconomic levels. Studies have shown that underserved people who live in low-income areas are more deprived of access to oral health services due to the increase in social inequalities (1-3). One of the major challenges may be a lack of adequately qualified dental personnel to meet the disadvantaged population's oral health needs (4). Furthermore, a fairly common belief among oral health care providers that these groups are challenging to handle could exacerbate the issue (2, 3, 5-7).

Dentists' willingness or reluctance to treat underserved patients may be influenced by their dental education (8-10). Several studies demonstrated that community-based educational experiences are correlated with dental students' tendency to provide dental services to underserved populations (5, 9, 11, 12). Nevertheless, some other authors documented that student's attitude does not necessarily depend on educational courses (5, 13, 14). It is, however, commonly accepted that dental education must promote access to oral health services and, eventually, close the oral health inequalities gap. Dental schools are supposed to train dental practitioners who embrace a social obligation to provide oral health services for underserved communities (6, 7, 11).

Recently, dental schools have integrated community-based programs into the dental curricula to improve the care of less privileged communities. Overall, the findings of these programs imply a better understanding of oral health disparities among dental students. Moreover, they acquired higher competency in providing oral health services for people experiencing poverty (15, 16).

Assessing students' attitudes toward community-based activities and providing services to vulnerable and underserved populations can help evaluate the achievement of goals and the effectiveness of these training programs (13, 17, 18). A popular instrument was designed to evaluate Medical Students' Attitudes towards Providing Care for the Underserved populations (MSATU questionnaire) by Crandall and Loemker in 1993 (19). In 2011, Habibian et al. modified this questionnaire to introduce a new tool for assessing Dental Students Attitude toward Underserved Populations (DSATU). This tool consists of 23 Likert scale questions divided into four domains that address societal expectations, student responsibility, personal efficacy, and access to care (5). So far, no study has been conducted in this field in Iran, and the appropriate instrument has not been designed in Persian. Therefore, this study aimed to translate and validate the Persian version of the DSATU questionnaire.

Objectives

This study aimed to assess and confirm the validity and reliability of Persian version of the DSATU questionnaire.

Methods

Study design: This validation study was carried out at Mashhad Dental School, one of the major active educational centers in community-based programs among Iranian dental schools.

DSATU questionnaire: This tool consists of 23 Likert scale questions divided into four domains: societal expectations, dental student/dentist responsibility, personal efficacy, and access to care. The choices vary from 1 (extremely disagree) to 5 (extremely agree), giving a total score ranging from 23 to 115. The items 1-7-11-20 were reverse questions, so their scoring was done upside-down.

Translation: In the first step in the transcultural adaptation process, the original version of the questionnaire was translated from English to Persian by two bilingual professionals whose native language is Persian. Afterward, the two translated versions were

merged, and the research team evaluated and agreed on it. The resulting questionnaire was back-translated into English by another language expert who did not know the English context of the questionnaire. Finally, a comparison of the original and back-translated versions showed the accuracy of the translation process.

Qualitative and Quantitative Evaluation of the Content and Face Validity: The questionnaire was introduced to nine academic tutors with PhD in community oral health for qualitative assessment of the content and face validity. They provided written feedback on the accuracy, completeness, scoring system, and placement of the items in the proper order.

The content validity ratio (CVR), based on the Lawshe scale (20), as well as the content validity index (CVI), were used for quantitative validation. The questionnaire was sent to the email addresses of 30 community oral health experts and professors from various Iranian dental schools. Nine experts completed the CVR/CVI checklist. Regarding the CVR formula (20), the panel members classify the necessity of each question based on the Likert scale into three categories: "3 = necessary", "2 = useful but unnecessary", and "1 = unnecessary". The CVR is calculated based on the ratio of the total number of experts who deemed the item necessary to the total number of the expert panel. The Lawshe table determines the minimal acceptable CVR score (Table 1).

Table 1. Lawshe table for minimal acceptable CVR values based on number of panelists

Number of panel members	CVR values
5	0.99
6	0.99
7	0.99
8	0.75
9	0.78
10	0.62
11	0.59
12	0.56
13	0.54
14	0.51
15	0.49

Item-CVI and scale level-CVI approaches were considered to determine relevance, clarity, and simplicity.

I-CVI: panel members rated relevance, clarity, and simplicity based on four- option on the Likert scale. The relevance of each item was defined with the options of 1 (not relevant), 2 (somewhat relevant), 3 (quite relevant), and 4 (highly relevant). The clarity and simplicity of each item were assessed with a similar pattern. The CVI was then determined for each item as the number of experts giving 3 or 4 rankings, divided by the total number of experts. If the items' CVI scores were under

0.79, the item requires further revision and modifications (21).

S-CVI: Average S-CVI was calculated by dividing the sum of I-CVIs by the all of items.

Impact Score: The questionnaire was presented to four dental students as a sample of the target group. They were asked to determine the importance of each item on the Likert scale with five options of 1 to 5 (not important to very important). The impact score for each item was calculated using the formula:

Percent of selected 4 and 5 scores \times mean score of the item. The item is considered important if the impact score is greater than 1.5.

Questionnaire reliability: Finally, the questionnaire reliability was assessed. The questionnaire was emailed to 40 students of Mashhad and Tehran dental schools. They were asked to complete the questionnaire two weeks later again. The internal consistency was assessed using Cronbach's alpha coefficient. The Intraclass Correlation Coefficient (ICC) and Pearson/Spearman's rank correlation coefficient were used to assess reliability. The statistical analysis was performed using SPSS version 22. [Figure 1](#) shows the stages of translation and psychometric assessment of the Persian version of the DASTU questionnaire.

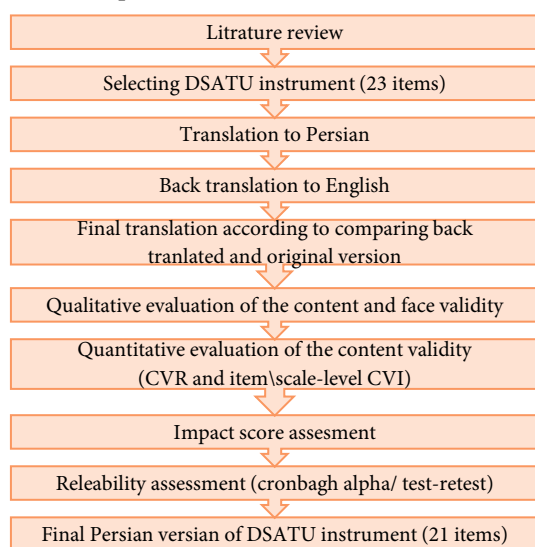


Figure 1. Flowchart of translation and psychometric evaluation of Persian version of DASTU questionnaire

Results

The translated questionnaire was reviewed and modified after receiving the expert panel comments. The questionnaire's items and psychometric properties (CVR, CVI, impact score) are presented in [Appendix 1](#).

Validity: Except for eight items, other items gained the acceptable CVR value. All items, except for items

2 and 6 of the first domain, had a CVI score of 0.78 or higher. Furthermore, Scale-level CVI (S-CVI = 0.98) was excellent. The impact scores showed that 20 questions had acceptable values (a score equal to or greater than 1.5).

Reliability: The test retest method, and Cronbach's alpha were used to evaluate the reliability. Twenty-five students (16 females and nine males) completed the questionnaire. The mean age of participants was 24.52 ± 1.91 years, ranging from 21 to 29 years. The average academic term of students was 10.56 (range 5 to 12).

Cronbach's alpha was used to examine the internal consistency of the items within the questionnaire. The total score of Cronbach's alpha (= 0.831) coefficient was acceptable. The Cronbach's alpha for the questionnaire domains, including societal expectations, student responsibility, personal efficacy, and access to care, were 0.617, 0.633, 0.739, and 0.489, respectively. Cronbach's alpha was assessed in the case of each item deleted too. The results showed that the alpha value of related domains would decrease in the case of deletion of 16 items.

Moreover, in the test-retest method, spearman's correlation coefficient was used to evaluate the correlation between the scores of each item. A significant correlation between 22 items was found that implied acceptable repeatability. The pearson's correlation coefficient was used to evaluate the correlation between each domain's scores and the questionnaire's total score ([Table 2](#)).

Table 2. Correlation values between questionnaire domains in test-retest

	Pearson's correlation coefficient	P-value
Societal expectations,	0.627	0.001
Dental student/dentist responsibility	0.684	0.001
Personal efficacy	0.861	0.001
Access to care	0.678	0.001
Total DSATU score	0.700	0.001

There was a significant correlation between each domain and the total score of the questionnaire. The correlation coefficient of the total scores of the questionnaire was 0.7. The findings of the ICC analysis are presented in [Table 3](#). The intra-class correlation coefficient between all of the domains was acceptable.

According to the results, two questions were removed from the questionnaire after validity evaluation: item 2 in the social expectations domain and

item 1 in the dentist's responsibilities. Also, according to the opinions of the honorable panel, questions 3 and 6 of the first domain, questions 2, 3, 4, 5, and 7 in the second domain, and question 3 in the third domain were revised and rewritten. Also, according to the results of Cronbach's alpha, question 3 was left out of the fourth domain, and the fourth score of Cronbach's alpha elevated to 0.537.

Table 3. Intra class correlation coefficient of each domain and total of the questionnaire

	ICC	P-value
Societal expectations,	0.726	0.001
Dental student/dentist responsibility	0.853	< 0.0001
Personal efficacy	0.801	< 0.0001
Access to care	0.918	< 0.0001
Total DSATU score	0.841	< 0.0001

ICC: Intraclass correlation coefficient

Discussion

Dental students can be positively influenced due to the collaboration engendered by common attitudes. On the other hand, the shared attitudes can be counterproductive to student learning (2, 3, 12). Although there is a lack of instruments to evaluate dental students' attitudes toward providing services to deprived populations, the dental version of the MSATU questionnaire is the most commonly used and comprehensive instrument (2, 5, 10, 19). The DSATU questionnaire includes four domains to measure students' attitudes toward societal expectations, student responsibility, personal efficacy, and access to care (5). Steinberg et al. used the DSATU questionnaire to assess the effectiveness of a medical ethics course in surgery. Findings showed that the ethical course improves students' attitudes toward disadvantaged groups (12). Moreover, Wayne et al. used this questionnaire in the New Mexico School of Medicine. Their study revealed that the attitude scores have dropped for most students during study courses (22). In line with this survey, Crandall et al. concluded that attitude scores of pharmacy students were more stable over time, while the MSATU scores of medical students decreased over four years (15). Although the results of the Habibian study showed that dental students' attitude scores decreased significantly over four years, students with a history of working as social volunteers had a significantly higher responsibility score. Moreover, females scored significantly higher than male students (5).

Dande et al.'s questionnaire was designed to assess students' personal efficacy in providing care for rural

populations (2). Additionally, the Health Professional Attitudes toward the Homeless Inventory (HPATHI) questionnaire was first introduced and validated by Buck et al. (23). All the HPATHI's items limit to provision services to the homeless population. Komaromy, et al.'s questionnaire, was designed and validated to evaluate the willingness of California physicians to provide dental health services for poor patients (10). The Komaromy questionnaire only addresses why some physicians are reluctant to treat poor and uninsured patients. Wieland et al. introduced a questionnaire to assess resident physician attitudes and behaviors regarding care for underserved patients. Although this questionnaire is similar to the DSATU questionnaire, some items (racial disparities) were not culturally appropriate to the Iranian context (24). In conclusion, the DSATU instrument seems to be an appropriate and fruitful questionnaire compared to the other relevant alternatives.

Habibian et al. used the opinions of six dental professors to check the questionnaire's validity qualitatively. So, using qualitative and quantitative assessments of validity could be considered one of this study's advantages (5).

Conclusion

The introduced Persian version of the DSATU questionnaire is a culturally adapted, valid, and reliable instrument for Persian researchers who intend to evaluate the attitude of dental students toward underserved and deprived populations. The coherence of all questions and domains was deemed appropriate. Moreover, it can be helpful to assess the influence of community-based programs in longitudinal studies.

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Conflict of interests: There is no conflict of interest.

Ethical approval: Mashhad University of Medical Sciences granted ethical approval for the study [IR.MUMS.DENTISTRY.REC.1399.106]. Informed consent was obtained from all subjects. Faculty members and dental students who consented to participate in the study, filled out the questionnaire. The questionnaires were anonymous and the data remained confidential.

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Appendix 1. Psychometric properties of translated DSATU questionnaire

No	Item	CVI-Clarity	CVI-Relevance	CVI-Simplicity	CVR	Impact score
Domain 1: Societal Expectations						
1	It is not the responsibility of the federal government to fund programs that provide dental care to the needy	0.78	1.00	0.78	1.00	2.81
2	Communities should be responsible for providing facilities for the care of the needy	0.56	0.89	0.67	0.56	3.19
3	It is the responsibility of church-related organizations to provide some funding for oral health care services	1.00	1.00	1.00	0.78	0.69
4	State government should be responsible for funding programs to meet the oral health care needs of its residents.	0.89	1.00	0.89	1.00	5
5	Churches should provide facilities for dental care of the needy	0.89	1.00	0.89	0.78	2
6	Society is responsible for providing for the oral health care of its members	0.67	1.00	0.78	0.78	1.63
Domain 2: Dentist/Student Responsibility						
1	Dentists should be responsible for providing oral health care to the needy.	1.00	1.00	1.00	0.56	3.19
2	Dentists should volunteer their time working in a free clinic.	1.00	0.89	0.89	0.56	4.5
3	Individual dentists should not be willing to provide care for their patients who cannot pay.	1.00	1.00	1.00	0.78	1.63
4	Dental students should be involved in providing dental care for the needy.	1.00	1.00	1.00	0.56	4.5
5	To care for needy patients, each dentist should allow for 15% of the care he/she provides to be true charity.	1.00	0.78	0.89	0.33	0.56
6	All dental students should become involved in community health efforts.	0.89	1.00	0.89	0.56	1.63
7	Dental students should not be concerned about the problems of the needy	1.00	1.00	1.00	0.33	0.69
8	All dental students should be involved in community activities.	1.00	1.00	1.00	0.78	0.69
Domain 3: Personal Efficacy						
1	I feel personally responsible for providing dental care to the needy.	1.00	1.00	1.00	0.78	3.38
2	I would be interested in volunteering for programs that provide dental care for the needy during my dental school academic tenure.	1.00	1.00	1.00	0.78	4.5
3	I feel I am personally unable to have an impact on the problem of meeting the dental needs of the underserved.	0.78	1.00	0.89	0.56	1.63
4	I personally want to be involved in providing care for the needy during my dental career.	1.00	1.00	1.00	0.78	5
Domain 4: Access to Care						
1	Dental care should be provided without charge for those who cannot pay.	1.00	1.00	1.00	1.00	4.5
2	Not everyone should have access to dental care.	0.78	1.00	0.78	0.78	1.25
3	Access to dental care is a privilege	0.78	1.00	0.89	0.56	4.5
4	People have a right to unlimited dental care regardless of their ability to pay	1.00	1.00	1.00	1.00	4.75
5	Access to oral health care is a right	1.00	1.00	1.00	1.00	5

Facilitators and Barriers to Using Virtual Education in Clinical Teaching

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Abstract

Background: Following the COVID-19 pandemic, in-person education has gradually resumed, while virtual education has emerged as more than just a temporary solution during quarantine. Due to generational changes and the characteristics of artificial intelligence Generation learners, universities are increasingly inclined to utilize virtual education. This study aimed to explore their experiences with virtual clinical teaching.

Objectives: The aim of this study was to explore the quality of the Virtual education in clinical setting for medical students.

Methods: We used a qualitative study approach. Utilizing data from semi-structured interviews with 14 clinical teachers in their virtual teaching. Lincoln and Guba's approach was used to determine data trustworthiness.

Results: Through the analysis of the collected data, one key theme consistently emerged across the findings, the "Complementing role of clinical education," there were two categories of clinical teaching facilitators and virtual clinical teaching barriers.

Conclusion: Virtual clinical education is a valuable supplement for medical learning endeavors, augmenting the quality of instruction and assimilation within this discipline.

Keywords: Medical Teacher; Clinical Teaching; Virtual Education; Facilitators; Barriers

Background

Given the current approach of societies and educational systems, professors worldwide are seeking evidence-based and scientific ways to improve the effectiveness of the curriculum. The COVID-19 pandemic has significantly impacted the educational system at various levels and affected professors' ability to meet the requirements in professional programs such as clinical education (1). Although in-person education gradually resumed after the normalization of conditions, especially in skill-based and clinical courses, it must be acknowledged that virtual education was not just a temporary solution to replace in-person education during quarantine. Instead, due to the generational changes and characteristics of AI Generation learners, universities

have shown a greater inclination toward utilizing this method of education (2).

Virtual education has gained prominence as a new paradigm in teaching and learning. In recent years, the development of virtual education has been a critical policy in higher education. These policies have been designed to promote educational justice, eliminate geographical constraints, and enable lifelong learning, necessitating universities to operationalize virtual education development programs (3).

Clinical education has unique characteristics that distinguish it from other types of education. In clinical education, direct interaction with patients, observation and practical skill training, and hands-on experience in real-world settings are paramount. Because of these characteristics, integrating virtual education with

clinical education presents specific challenges. These challenges include creating simulated environments for practicing practical skills, utilizing multimedia tools for theoretical and practical instruction, and managing student-teacher and student-patient interactions in the virtual space (4, 5).

Considering the characteristics of the virtual education environment, such as its prominent environment, educational tools, and resources used, virtual education in clinical curricula has distinct meanings and consequences. According to conducted studies, virtual education creates a new and distinct context due to its distinct elements, such as distance learning, multimedia, learning management systems, and course delivery and communication styles. These elements bring about new potential issues related to the clinical curriculum (6-8).

In medical education, where the half-life of knowledge is shorter compared to other sciences, the shift towards utilizing heutagogy theory and training competent lifelong learners who can respond to the needs of society has become a necessity for medical students. Furthermore, with the move towards heutagogy and constructivist theories, the diversity and nature of learning subjects seem to complicate the instructional design. This indicates that clinical professors are facing significant challenges, especially in the clinical environment with various unexpected content and rapid technological advancements in medical knowledge. However, the choice of teaching method will depend on the learner's needs, the subject matter, teaching conditions, and ultimately, the desired level of learning achievement (9, 10).

Since clinical education is considered the heart of medical education, having knowledge of virtual education in clinical education can enable virtualization, the design of suitable curricula, the development of curricula based on stakeholders' needs, the promotion of educational justice, access to educational resources anytime and anywhere, as well as assessment and evaluation of learners in the virtual space, considering the implementation of justice. This study seeks to examine faculty members' experiences at the Medical School of Iran University of Medical Sciences with virtual clinical education and to develop practical strategies for integrating it into the medical curriculum. The importance of this research lies in the need to identify and assess the factors that enable or hinder the adoption of virtual education in clinical teaching. Doing so can improve the quality of education, increase access to clinical training, save time and costs, and prepare the

workforce for the future. Additionally, this study can address the immediate and long-term needs of the medical community and enhance educational infrastructure to handle future crises better. Analyzing faculty members' experiences using virtual education can also provide valuable insights for better developing and implementing virtual clinical curricula.

Objectives

The aim of this study was to explore the quality of the Virtual education in clinical setting for medical students.

Methods

This qualitative study was conducted with a content analysis inductive approach to elucidate the experience of faculty members at the medicine faculty of Iran University of Medical Sciences regarding virtual clinical education. After formulating the research questions participants were selected using purposive sampling from among faculty members from the Medical School. As a principal criterion, the participant's willingness to share their experience. The participants had teaching experience in the clinical setting during the Covid era. The participants were selected to ensure maximum variation in terms of gender and age from educational, clinical departments with different educational approaches. Data were collected through semi-structured interviews with 14 faculty members affiliated with the Medical School of Iran University of Medical Sciences (Table 1).

Interviews were conducted in a setting that was suitable for the participants. Most Interviews are conducted in faculty schools.

Table 1. The demographic information of the participants

Specialized field	Gender	Age	Teaching experience
Obstetrics and gynecology	Female	42	10 years
Obstetrics and gynecology	Female	51	13 years
Orthopedics	Male	47	15 years
Orthopedics	Female	58	20 years
Emergency medicine	Male	39	5 years
Dermatology	Female	56	25 years
Ophthalmology	Female	63	28 years
Neurology	Male	40	12 years
Urology	Male	41	9 years
Urology	Female	59	22 years
Social medicine	Female	57	17 years
Forensic medicine	Female	38	7 years
Otorhinolaryngology	Male	62	25 years
Neurosurgery	Male	68	30 years

The interviews lasted about 35 Min. A voice recorder recorded the interviews. The interview was conducted by the first and corresponding authors.

The interviews began with initial questions that were open-ended, such as "Have you had any prior experience with virtual clinical education or related initiatives?", "Have you had any prior experience with virtual clinical education or related initiatives?", "What are the differences between face-to-face teaching and virtual teaching?", "Say about the evaluation in virtual education?", based on the necessity, probing questions were used to steer the research toward its objective.

Data analysis: The interview stopped when new data repeated what was expressed in previous data. Data analysis was started immediately after the first interview and continued simultaneously with the data collection process. All authors contributed to the data analysis. The analysis model used in this study was the Elo and Kyngas model (11). The process involved open coding, category-making, and theme. Open coding was conducted by writing notes and titles in the text and then reading them. Important points were noted in the margin of the text to describe all the dimensions of the content in question. Then, the notes were collected and written on the coding sheets. Subsequently, the list of categories was determined. The purpose was to compress the data and reduce its quantity by grouping similar data. The subcategories were classified together to form the main categories. The theme process continued to the extent that it was reasonable and feasible.

Trustworthiness: Lincoln and Guba recommend criteria for establishing the data's trustworthiness (12). Various techniques were used to increase the credibility of the findings. An attempt was made to observe maximum variation in sampling. For exploring the credibility of results member check was also performed. The researchers tried to prevent their suppositions from affecting the interpretation of the findings. There was long-term engagement with the data. The researchers tried to select the best sentences as the primary codes. To

increase the dependability of the findings, the researchers asked an external researcher to comment on the data. To increase the transferability of the findings, the results were given to individuals who were not included in the study sample but had virtual clinical teaching experiences, and the findings were compared and confirmed.

Results

Based on the data analysis, 8 subcategories emerged from the initial codes, which were further grouped into 2 categories. Ultimately, 1 theme was identified (Table 2).

Complementing Role of Virtual Clinical Teaching

The main theme is "Complementing role of Virtual clinical teaching", which has two subcategories: "Virtual clinical teaching Facilitators" and "Virtual clinical teaching Barriers". Virtual education offers some benefits, such as saving time and money, but according to faculty members, it is not enough for clinical training. Clinical training requires skill acquisition in a real environment, involving situated learning, direct observation, and hands-on practice. These elements differ from virtual education, which cannot comprehensively cover all educational aspects regardless of their quality and currency; virtual environments are ineffective in transferring clinical, educational goals.

Here are some quotes from the professors regarding this concept:

"Sometimes the classes are so crowded that managing the class becomes difficult, or sometimes our educational resources are limited, and virtual education is a great solution in these situations" (Participant 1).

"I have mixed feelings about it. Our department has in-person and virtual education, and the students also appreciate it. However, certain things cannot be taught virtually. The students need to see the professor exactly doing what they are supposed to do... (sighs) Honestly, I don't fully accept that virtual education course..."(Participant 4).

Table 2. Theme, categories, and subcategories

Theme	Category	Subcategory
Complementing the role of virtual clinical teaching	Virtual clinical teaching facilitators	View more cases by medical student
		Encouraging students to collaborate for educational purposes
		Ensuring the long-term accessibility of educational materials
	Virtual clinical teaching barriers	Weakness in transferring learning by role models and situated learning
		Insufficiency in obtaining clinical communication skills
		Difficulty in educational evaluation
		Lack of knowledge and skills of instructors in virtual education
		Inefficient technical support

"For example, putting in an IUD or removing it, taking a pap smear, or suturing (pause) things like these. Well, in our field, you can teach all of these through virtual means. But when it comes to performing an appendectomy, the students need to see if they have gained the necessary expertise or if they have acquired practical skills. You can ask them about the theory, and they can answer it nicely, but the practical part must be hands-on..." (Participant 2).

"The students say they can refer back to the previous session when needed, but its weaknesses are that the students have become less efficient, and they have less interaction with the education and their social connections..." (Participant 11).

Virtual Clinical Education Facilitators

Participants in this study found virtual education during the COVID-19 pandemic to be a valuable teaching opportunity for professors and students. Based on the analysis of data, participants believed that this form of education created effective opportunities through the three main categories of "View more cases by medical student", "Encouraging students to collaborate for educational purposes", and "Ensuring the long-term accessibility of educational materials". In virtual education, learners can participate in classes from anywhere. Collaboration in lesson delivery and the availability of teaching materials are feasible for students. This allows students and enthusiasts to attend other classes, journal clubs, and morning sessions many times. Recording classes and educational materials also greatly assisted students in extending their learning time.

Here are some quotes from the professors regarding this concept: "I found it interesting because, in collaboration with a friend who works at [University name], we shared cases with students, and students from both universities participated" (Participant 4).

"We recorded classes, which allowed students to watch the classes repeatedly. It was very helpful because we didn't have this option before..." (Participant 7).

Virtual Clinical Education Barriers

The second category is "virtual clinical education barriers", which comprises "Weakness in transferring learning by role models and situated learning", "insufficiency in obtaining clinical communication skills", "Difficulty in educational evaluation", "Lack of Knowledge and Skills of Instructors in Virtual Education" and "Inefficient Technical Support". These dimensions are crucial for the curriculum, and

neglecting them could have negative consequences. The participants stated that virtual education limits interpersonal interactions and communication in the educational context. Communication, especially with patients and colleagues, is a vital aspect of medicine that virtual education cannot effectively convey. Moreover, students cannot observe the role modeling of professional behavior with patients by professors in virtual education, which impedes their learning of professional conduct. Another important aspect in this category is the neglect of ethical and value dimensions of the curriculum in virtual education. The participants believed that many ethical issues in medicine, such as patient privacy and value-related matters, cannot be taught effectively through virtual education. Students learn how to deal with ethical issues in patient care and educational environments, which virtual education cannot provide.

"The quality was not satisfactory in this regard. Only a few students could make optimal use of this time and maintain their quality through extensive and purposeful studying with proper planning. However, they were still weak in-patient interaction, examination, and communication" (Participant 7).

"I believe the problem lies in the loss of direct interaction with patients and the discussion of non-technical skills or non-technical competencies. Ironically, these skills can be taught in the virtual education environment, but our knowledge and skills are still very low, and we couldn't teach it well" (Participant 14).

"We had issues with patients. It was challenging to select patients because the information they share is confidential, and it was possible to record and share that information in different groups. This prevented us from naturally utilizing all cases and constantly posed challenges. Many colleagues suggested using actors or standard practices, but using actors also has drawbacks, as individuals don't interact with a real environment" (Participant 3).

Since virtual education was imposed on the educational system without prior planning, it is natural that the internet infrastructure was not ready, leading to various challenges for virtual education and the educational system. Furthermore, the use of existing software was not suitable for clinical education. On the other hand, instructors' lack of knowledge and skills in online and virtual teaching was another challenge in clinical education. However, after two terms, many initial challenges in learning electronic teaching

methods were resolved. The most frequently mentioned issues in almost all interviews were the lack of control over student learning, reduction in the quantity and quality of education, low quality of student grades, lack of diverse educational opportunities for students, decreased class interaction and question-and-answer sessions, poor transferability and understanding of course concepts, and low quality of educational content, which indicate a decline in the quality of education from the perspective of faculty members.

"Quotes from instructors regarding this concept include one about the difficulties specific to our country, where internet connectivity and such are challenging. However, the conditions and culture are unsuitable for this, and it might be challenging to tell them their time is limited. Moreover, when there is no eye contact and direct communication, it becomes difficult to transfer many concepts..." (Participant 9).

"The prepared files are often not of suitable quality. Students often complain that it feels like the instructor is simply reading from their PowerPoint slides, and they don't feel that the content is being effectively conveyed..." (Participant 2).

"During the covid 19, all the hospital departments were dedicated to covid 19. It wasn't easy to teach students. We had no tools for evaluation. We had no disease to teach. Most of the patients were infected with covid 19. Our evaluation was only documentation such as a logbook and sending activities in virtual form. The evaluation was not done properly because quality training was not provided..." (Participant 11).

Discussion

Administrators and medical educationists are compelled to seek innovative technologies to maintain high-quality medical education. These technologies will significantly impact how their institutions deliver medical education in the future. Current virtual learning management systems (LMS) offer numerous benefits, including accessibility to educational content anytime, anywhere, asynchronous discussions, and flexibility. However, the challenge lies in applying virtual learning effectively to teaching clinical knowledge. The latest advancements in flexible educational technologies hold the potential to revolutionize medical education. By embracing interactive virtual learning, these technologies can facilitate clinical training moving forward (13).

Focusing on a critical gap in research, this study examines clinical teachers' views on virtual education's

role in clinical education. Doing so unveils several advantages of virtual education, potentially paving the way for improved training methods.

Increased Access to Cases: Participants highlighted virtual platforms' ability to showcase a wider variety of medical cases compared to traditional in-person settings. This finding aligns with previous research [mention specific studies if available]. To address this educational need, several online learning platforms have facilitated the move of clinical didactic sessions to a virtual environment (14, 15).

Enhanced Collaboration: Participants found virtual environments surprisingly effective for fostering student collaboration. Virtual platforms facilitate group discussions, case studies, and joint learning activities, promoting teamwork and knowledge exchange. This aligns with the general optimism in literature reviews regarding virtual education's potential to support collaboration in clinical settings (16, 17).

Enhanced Accessibility and Personalized Learning : Virtual learning environments offer significant advantages in accessibility and personalization of learning materials. Participants' feedback from virtual lectures and the vast availability of online resources have informed the creation of more accessible learning materials. This allows students to engage with the materials at their own pace and convenience, fostering deeper understanding. This aligns with research demonstrating the positive impact of online resources on e-learning in educational settings. Additionally, virtual clinical learning serves the crucial function of providing readily available online information resources. This addresses limitations imposed by physical or classroom constraints, ultimately enhancing students' learning abilities (18, 19).

However, the study also identifies significant challenges associated with virtual clinical education. These challenges require careful consideration to ensure optimal learning outcomes in this evolving educational environment.

Limited Role-Modeling and Situated Learning: Participants acknowledged the difficulty of replicating the nuances of real-world clinical experiences through virtual platforms. Observing faculty interact with patients and navigate complex situations is crucial to student development, fostering essential non-technical skills. As one participant emphasized, role modeling is vital in acquiring these skills. This aligns with existing literature that highlights the role of clinical teachers as supporters who provide students with opportunities to

observe their interactions with patients [mention specific studies if available]. However, virtual education may currently limit these opportunities for direct clinical observation (20-22).

The study participants strongly advocate for the continued importance of face-to-face clinical teaching in cultivating essential competencies and understanding for medical students and graduates alike. Direct patient interaction, mentorship from experienced clinicians, and hands-on experience within hospitals solidify the value of in-person education. Moreover, actively participating in patient care and grappling with real-world medical challenges in a tangible clinical environment fosters strong clinical reasoning skills, equipping graduates to make informed decisions in future scenarios (23, 24).

To fully harness the potential of virtual education, fostering teacher awareness and preparedness is crucial. While some instructors may have initially lacked experience, the rapid shift to online platforms has demonstrably boosted their technological skills. Building on this momentum, targeted training and informative resources can equip teachers to integrate virtual tools into their teaching repertoire effectively. This will ensure a more comprehensive educational experience that leverages the strengths of both traditional and virtual methods (25, 26).

Potential Impact on Communication Skills: Virtual environments may limit opportunities to develop the nuanced communication skills crucial for successful patient interactions and collaboration with colleagues. While extensive research explores the patient-provider relationship in primary care settings, the dynamics of telemedicine communication remain under-investigated. An earlier study analyzing communication styles during virtual visits found a dominance of physician talk and a higher frequency of requests for repetition, suggesting potential difficulties in perception and information exchange within telemedicine settings (27).

The convergence of technological advancements and the growing digital fluency of medical students necessitates acknowledging the importance of virtual education as a complementary tool to traditional classroom learning. Virtual programs offer interactive multimedia experiences leveraging modern technologies to equip students with clinical skills and practical medical knowledge within simulated environments. Furthermore, e-learning empowers students with self-paced learning and the ability to

optimize their use of educational resources. This approach proves particularly advantageous in geographically restricted areas where access to physical training opportunities may be limited (28, 29). This study highlights the strengths of both in-person and virtual education in medical training. While face-to-face interaction remains paramount for cultivating essential competencies, virtual education offers valuable supplementary tools. By fostering teacher preparedness and strategically integrating virtual platforms, educators can create a comprehensive learning experience that equips future medical professionals with the knowledge and skills they need to thrive in an evolving healthcare landscape (30-33).

Virtual education offers medical students the unique opportunity to learn and practice in scenarios where physical presence might be impractical. By leveraging digital technologies, virtual clinical education can enrich students' practical expertise and hone their clinical judgment skills. One such powerful tool is Virtual Patients (VPs). These meticulously designed computer programs simulate real-world clinical scenarios, exposing students to situations that may be difficult or impossible to encounter in real-world settings (34). Therefore, virtual clinical education is a valuable supplement to traditional medical education, enhancing the quality of instruction and knowledge retention within the field.

One of the limitations of this study was the participants did not have enough time to present their experiences. They were busy. The interview was difficult.

Conclusion

With its interactive multimedia capabilities and simulated environments, virtual education offers a valuable complementary tool to traditional face-to-face instruction. It can enhance learning by providing access to a wider range of resources, facilitating self-paced learning, and enabling students to practice in scenarios that may be difficult or impractical to replicate in real-world settings.

The key to maximizing the benefits of medical education lies in embracing a synergistic approach that integrates the strengths of face-to-face and virtual education. By leveraging the immersive, hands-on nature of traditional clinical training alongside the flexibility and accessibility of virtual learning platforms, medical educators can create a comprehensive and well-rounded educational experience that prepares

future physicians for the challenges and demands of the healthcare profession.

In conclusion, while virtual education has emerged as a valuable tool in medical training, it should not overshadow the enduring importance of face-to-face clinical education. By recognizing the unique strengths of each approach and adopting a synergistic approach, medical educators can cultivate a generation of physicians who possess the clinical expertise, interpersonal skills, and collaborative spirit essential for providing exceptional patient care.

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Usability Evaluation of Electronic Learning Management Systems in the University of Medical Sciences

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Abstract

Background: With the Covid-19 pandemic, higher education communities almost worldwide have switched from traditional face-to-face education to distance learning and the use of electronic learning management systems (ELMS) in universities increased greatly; so that today online and electronic education is being done as an important part of education. These conditions have caused new challenges to the usability of these systems. In this study, some of these problems were investigated at Kerman University of Medical Sciences.

Objectives: The aim of this study was to evaluate the usability of electronic learning management systems at Kerman University of Medical Sciences.

Methods: This cross-sectional and descriptive study evaluated the usability of the Navid system, Skyroom, and Adobe Connect using a heuristic evaluation. Three evaluators independently evaluated these systems using the Nielsen heuristics. Data were analyzed using descriptive statistics (frequency, percentage, and mean) using SPSS and Excel software. Finally, the information related to the problems (problem, its related heuristic, severity rating of the problem and its occurrence location) were presented in tables.

Results: A total of 106 usability problems were identified in ELMS. The skyroom showed the largest number of problems detected (52 cases), and the lowest number of problems was observed in the Navid system (22 cases) and Adobe Connect (39 cases). Some heuristics, such as 'error prevention' and 'Help and documentation,' had more suitable conditions. But in terms of 'flexibility and efficiency of use,' there was no suitable situation; So that the most problems in the Navid system and Skyroom were classified in 'flexibility and efficiency of use' (45.45% and 23.07%, respectively), but the largest number of problems in Adobe Connect were related to 'help users recognize, diagnose, and recover from errors' (38.46%).

Conclusion: The usability of ELMS in universities and the learning experience of learners can be improved by using the principles of usability and appropriate interface design. This will help designers of these systems to provide better systems with the ability to improve the quality of teaching and learning.

Keywords: Usability; Electronic Learning Systems; Heuristic

Background

Electronic learning refers to the learning methods of electronic educational content that is provided through the Internet (1-5) and provides an opportunity for students and teachers to interact. Several studies have highlighted the benefits of using the Internet in education, and it seems that virtual education has been

welcomed by student (6). The growth of e-learning has affected the way learners learn and communicate in the educational environment, and learning management systems are being developed. These systems are designed to track registration status, attendance, grades, class schedule, test results, and other university and classroom management requirements and are special

platforms that make it possible to present content through digital tools (7).

With the covid-19 pandemic, universities have been forced to conduct many of their educational activities using video conferencing software and online learning platforms to maintain social distancing, and online and electronic learning have remained an important part of education. Although professors and trainers have several training options, this type of training has presented new challenges regarding the usability of these systems (8).

Usability is considered a key concept in learning management systems. When designing and developing electronic learning systems, the principles of usability are applied in designing web-based user interfaces and application software so that users can easily access educational content and tools and react effectively by using them (9). The use of modern technologies can improve the usability of electronic learning systems. Using features, such as videos, interactive images, simulations, and interactive tools, can make the learning experience more attractive and meaningful. In addition, providing facilities such as language translation, paying attention to the needs of students with visual or hearing problems, and providing clear and complete explanations about how the system should be used can also help increase the usability of electronic learning systems (10).

The interface of electronic learning systems and their design can make it easy for learners to access the content of courses and be effective in encouraging learners or professors to use these systems and expand their use (6); however, if the electronic learning systems are not well and sufficiently equipped, it causes discouragement, frustration, and anxiety in users and reduces their interest in using the systems (8). Therefore, the low usability of electronic learning systems is an important factor in users non-acceptance (11).

Various studies have evaluated academic electronic management systems, and the results have demonstrated that although these systems were accepted in universities, there are significant challenges related to their usability (5). Penha et al. suggested that there were many problems using e-learning systems, which caused inappropriate and sometimes unpleasant user interactions and made it difficult for users to use these systems. Owing to the lack of basic principles of design and usability in these systems, there was overload and, in some cases, unnecessary content, inconsistency of messages, and inappropriate language were also observed. In addition, the design is not properly

standard (12). Evaluating the usability of electronic management systems, Mtebe and Kissaka showed that some of these systems have usability problems that prevent their effective use (13). The research conducted by Fatma Tansu and Akbari Samani concluded that the electronic management system used in the Eastern Mediterranean University should be developed in terms of uploading new content and adding new features (14). Emiroğlu's study found that there were some usability problems such as system loading speed, site structure, grading mechanism, homework management, special language support, content abuse, and filtering (15). Melton's study showed that the success rate of sending homework using a learning system was 50%, and it was necessary to improve the system in this area. Another usability problem is that the visited links are not distinguished from the non-visited links (16). In Alshehri et al.'s research, information quality, system navigation and interactivity, system learning, and visual design were important aspects of electronic learning systems (17).

The research showed that if the usability of a learning management system is not at the desired level, learners would focus on learning the system itself instead of learning the content (18). On the other hand, despite the growing trend of using electronic learning management systems in higher education all around the world, a few studies have been conducted in the field of evaluating the usability and examining the possibilities of these systems in the higher education setting in Iran. The lack of sufficient information about the usability and possible obstacles of these systems can prevent their optimal design and effective use. In addition, it is necessary to understand the strengths and weaknesses of different learning management systems to improve their performance.

Objectives

The aim of this study was to evaluate the usability of electronic learning management systems at Kerman University of Medical Sciences.

Methods

This cross-sectional and descriptive study evaluated the usability of electronic learning management systems (ELMS) used at Kerman University of Medical Sciences, including the Navid system (<https://kmunavid.vums.ac.ir>), Skyroom (<https://sr.kmu.ac.ir/>), and Adobe Connect (<https://oc.kmu.ac.ir/>) by using heuristic evaluation. Three evaluators independently evaluated these systems using the Nielsen heuristics (19) and prepared a list of

usability problems at the interfaces. The evaluators had academic education in the field of medical library and information sciences, specialized in the field of interfaces, and conducted research in this field. In addition, they had experience working with ELMS and had used these systems in their teaching.

The set of usability principles, Nielsen, is as follows (19):

- 1- Visibility of system status
- 2- Match between system and the real world
- 3- User control and freedom
- 4- Consistency and standards
- 5- Error prevention
- 6- Recognition rather than recall
- 7- Flexibility and efficiency of use
- 8- Aesthetic and minimalist design
- 9- Help users recognize, diagnose, and recover from errors
- 10- Help and documentation

First, meetings to unify concepts were held in the presence of evaluators and experts in the field of human-computer interaction. Ten items on how to extract problems were reviewed at these meetings. The evaluators then individually performed the evaluation based on the "severity rating" criterion. The severity rating of a usability problem is a combination of three factors: 1) Frequency of the problem: is the problem common or rare? 2. Impact of the problem: Is it easy or difficult for users to overcome a problem? 3- Persistence of the problem: Does the problem repeat itself once, and if the users are aware of it, can they overcome it, or are they constantly bothered by it?

The evaluators rated each usability problem using 5-point rating scale. The severity rating scale is shown in following:

1. 0= I don't agree that this is a usability problem at all
2. 1= Cosmetic problem only: need not be fixed unless extra time is available on project
3. 2= Minor usability problem: fixing this should be given low priority
4. 3= Major usability problem: important to fix, so should be given high priority
5. 4= Usability catastrophe: It is imperative to fix this before the product can be released (20). The final list of usability problems was provided to the evaluators to determine the severity rating of the problems independently. The average severity rating assigned by the evaluators was considered the final severity of the problems, and the final ratings were calculated and declared in %. In this study, a standard usability checklist was used to collect data, and its validity was confirmed (20).

All items were discussed by the evaluators in meetings to ensure the reliability of the checklist, and agreement was reached regarding their perceptions. Previous studies have also measured the reliability of this checklist in the same way (21). Three researcher-made forms were used to enter the problems in a categorized manner. Each evaluator recorded the problems using Form 1. This form consists of a table including the problem name, problem description, problem location, and the corresponding "heuristic." Form No. 2 included the final problem, description of the final problem, location of the final problem, relevant heuristic, and relevant system. The researcher completed the study. Form 3 was used to determine the severity rating of the final problems, which was completed by the evaluators and included the name of the problem and the severity rating scale.

Descriptive statistics (frequency, percentage, and mean) were used to analyze the research findings. The information related to the problems (problem, its related heuristic, severity rating of the problem, and its occurrence location) is presented in tables. Finally, the obtained data were analyzed using SPSS software version 20 (version 20, IBM Corporation, Armonk, NY, USA) and Excel.

Results

Based on Nielsen heuristics, 106 usability problems were found in ELMS of Kerman University of Medical Sciences.

Note that Skyroom showed the largest number of problems detected (52 cases) and the lowest number of issues were observed in Navid system (22 cases) and Adobe Connect (39 cases) (Figure 1).

According to Table 1, the most problems in the Navid system were classified in 'flexibility and efficiency of use' (45.45%). No issues related to 'helping users recognize, diagnose, and recover from errors' were observed in the Navid system. The high percentage of problems in Skyroom were also classified as 'flexibility and efficiency of use' (23.07%).

The largest issues in Adobe Connect were related to 'helping users recognize, diagnose, and recover from errors' (38.46%). In this system, the problems related to 'visibility of system status' and 'match between system and the real world' were not found. Problems related to 'error prevention' and 'help and documentation' were not observed in any of the electronic learning management systems (Table 1).

Table 2 shows that Adobe Connect had no problems in terms of 'visibility of system status'. In the Navid system and Skyroom, the high percentage of problems

identified in 'visibility of system status' were mainly due to 'failure to provide (new) information or system feedback following a user's action'. In Adobe Connect, there were no problems related to 'match between system and the real world'. All the problems identified in 'match between system and the real world' in the Navid system and 60% of these problems in Skyroom were due to the 'ambiguity in commands, information, signs, and options'. 'lack of appropriate functional options (buttons) to start system activities' was observed in all the systems. The highest number of this problem was observed in Skyroom (50%) and the lowest number of problems in this field was related to the Navid system (33.33%).

Half of the problems related to 'consistency and standards' in Skyroom were due to the 'using of heterogeneous layout and design to display information and buttons'. All the problems in the Navid system and Adobe Connect were due to the 'absence of search button on all pages' and 'non-use of uniform items that users are used to', respectively. In all systems, there was no exit button in the main menu (being in the submenu). The highest number of this problem was observed in the Navid system (100%). In Skyroom, the most problems observed in 'recognition rather than recall' were related to the 'impossibility of recognizing the use of available buttons according to their labels'. Twenty percent of problems identified in 'flexibility and efficiency of use' in the Navid system were related to system shutdown while conducting online tests/updating the system. Among the significant problems of 'flexibility and efficiency of use' in Adobe Connect, we can mention the impossibility of writing Farsi correctly in this system.

Half of the problems classified in 'aesthetic and minimalist design' in Navid system were due to 'existence of too much information on the pages' and the other half were due to 'the lack of suitable visual icons in the design'. The most aesthetic problems in Skyroom were related to 'repetition of buttons and icons' and 'inappropriate board design'. In Adobe Connect, aesthetic problems such as 'inappropriate color of pages', 'inappropriate board design', 'crowded pages' and 'complexity of menus' were observed. In Navid system, there was no problem in terms of 'help users recognize, diagnose, and recover from errors'.

The most problems in terms of 'help users recognize, diagnose, and recover from errors' in Skyroom and Adobe Connect were due to 'use of inappropriate error message in response to user action' (Table 2).

Additionally, evaluators rated 50% of the problems in the Navid system as 'major' and 50% of them as 'catastrophic'. The most problems in Skyroom were 'Major' (57.69%). More than half of the problems in Adobe Connect were 'catastrophic' (51.28%) (Table 3).

In the Navid system and Adobe Connect, most usability problems were related to the main page (the whole system) (45.45% and 51.28%, respectively). In Skyroom, more than 30% of the problems were related to using the board (34.61%) (Table 4).

Discussion

Today, with the increase in the need for online education and the use of electronic learning management systems, the learning management systems used in universities have also increased and they are equipped with the ability to provide content and online educational facilities (22).

In our study, a total of 106 usability problems were identified in different parts of these systems. Some of the problems overlapped with the results of previous studies in this field (12, 13, 23). For example, in Mtebe and Kissaka's study, 9 usability problems were found in the learning management system of the University of Dar es Salaam (13). In the evaluation of Info3Net in the Ssemugabi study, 75 usability problems were identified (23).

The results of our study showed that in the Navid system, 50% of the problems were 'major' and 50% were 'catastrophic'. The most problems in Skyroom were reported as 'major' (57.69%). More than half of problems in Adobe Connect were 'catastrophic' (51.28%).

In this study, all of Nielsen's heuristics were violated and there was no problem with the 'error prevention' and 'help and documentation' heuristics. While Penha et al. evaluated the interface of e-learning management systems used in the Instituto Federal de Pernambuco (IFPE), they identified 54 usability problems. All Nielsen's heuristics were violated in Moodle, Blackboard, Teleduc, Aulanet, and Amadeus systems, and the lowest number of problems was related to 'help and documentation' (12).

One of the important factors in the usability of electronic learning systems is their simplicity and ease of use. The interface of electronic learning systems should be simple, understandable, and familiar to users so that they can easily move in the educational environment and take advantage of the available tools and resources. Also, they should be adaptable to the needs and preferences of users so that they can fully respond to their demands and expectations (10).

While the results of our study showed that the most usability problems in the Navid system and Skyroom were identified in 'flexibility and efficiency of use', in Adobe Connect, the most problems were related to 'help users recognize, diagnose, and recover from errors'. In such a way that sometimes the system could not display the desired page and there was no error message to show what happened and suggest a solution to the problem. An efficient system should provide an appropriate error message at appropriate times in response to the user's action.

In the Penha et al. study, after 'consistency and standards', 'flexibility and efficiency of use' showed the highest number of problems in electronic learning management systems (12). In the Eastern Mediterranean University (EMU), the investigated system (Moodle) had good flexibility and according to the evaluators, it provided the possibility of efficient use for experienced and inexperienced users. Also, this system was successful in identifying and improving errors; because the errors were expressed in simple language (without codes) (14). To improve usability, providing appropriate and timely feedback to users is also very important (24, 25).

In the present study, the most flexibility problems identified in the Navid system were due to 'system shutdown while conducting online tests/updating the system'. Among the significant problems identified in 'flexibility and efficiency of use' in Adobe Connect, we can mention the 'Impossibility of writing Farsi correctly'.

In Emiroğlu's study, the learning management system did not support the Turkish language in some parts of the program (15), which shows that learning system designers should pay attention to this issue and consider flexible options to help users achieve their goals and increase the efficiency of e-learning management systems.

In the study of Eltahir et al., most evaluators of e-learning courses at Ajman University agreed that there is not enough capacity in the used e-learning system and to achieve a more flexible system, the capacity of the system should be increased in such a way that it is possible to load more data in the form of sound, image, video, and recording of lectures (26).

In the evaluation of Adobe Connect, no problems were found in the 'visibility of system status'. In the Navid system and Skyroom, the most problems identified in 'visibility of system status' were due to 'failure to provide (new) information or system feedback following a user's action'; while the system should always inform the user about the current situation at the right

time through appropriate feedback (27). In the Penha et al. study, 11% of usability problems were related to 'visibility of system status' (12), but in the study of Fatma Tansu and Akbari Samani, the system used in the Eastern Mediterranean University had appropriate visibility and at the right time, it provided appropriate feedback to the evaluators (14).

In this research, there was no 'match between system and real-world' problem in Adobe Connect. In the study of Fatma Tansu and Akbari Samani, the heuristic of 'match between system and real world' was well observed and instead of system-oriented terms, words, phrases, and concepts familiar to the user were used (14).

All the problems identified in 'match between system and real world' in the Navid system and 60% of these problems in Skyroom were due to 'ambiguity in commands, information, signs, and options'.

In the Skyroom, half of the problems identified in 'Consistency and standards' were due to the 'using of heterogeneous layout and design to display information and buttons'. All the Consistency problems of the Navid system and Adobe Connect were due to the 'absence of search button on all pages' and 'non-use of uniform items that users are used to', respectively. In Penha et al. research, most of the problems identified in consistency and standards were due to the lack of uniformity in the environment design (12). In the learning management system of the Eastern Mediterranean University, 'consistency and standards' was observed on average (14). It is suggested to use a specific policy and uniform items that users are used to in the design of systems and avoid using words, terms, or functions that have different meanings.

In all three systems examined in our study, there was the problem of 'lack of exit button in the main menu'. Most of this problem was observed in the Navid system.

In Skyroom, the most 'Recognition rather than recall' problems were related to the 'Impossibility of recognizing the use of available buttons according to their labels'. The system should reduce the user's mental pressure by creating visible objects, operations, and options. In other words, the system should help identify operations and options so that the user needs less mental and physical activity and the instructions for working with the system should be visible and accessible (26). For example, users recognize images very quickly. Therefore, the instructions for working with the system can be explained with images. These images are a good way to convey functionality to users (28). In Fatma Tansu and Akbari Samani's study, designers minimized

the user's mental pressure by making objects, actions, options, and instructions visible (14).

Half of the problems identified in 'aesthetic and minimalist design' in the Navid system were due to the 'existence of too much information on the pages' and the other half were due to 'the lack of suitable visual icons in the design'. The problems classified in 'aesthetic and minimalist design' in Skyroom were due to 'repetition of buttons and icons' and 'inappropriate board design'. In Adobe Connect, 'aesthetic and minimalist design' problems such as 'inappropriate color of pages', 'inappropriate board design', 'crowded pages', and 'complexity of menus' were observed.

Additional and repetitive information on pages causes distraction and reduces performance. Systems designers should avoid duplicate information to increase readability so that users can focus on the main topic and without getting confused by irrelevant images or texts, they can easily find the information they need (28, 29).

In Penha et al. study, most of the 'aesthetic and minimalist design' problems were related to excessive content of information on some pages, inappropriate use of items, and confusing banners (12).

Limitations: Conducting evaluation only in one university, conducting evaluation only from the point of view of evaluators, failure to consider environmental factors such as hardware and software facilities related to the usability of the systems, which sometimes led to the lack of access to the systems in some cases.

Conclusion

The results of our study showed that many problems were observed on the home page of the electronic learning management systems. Some heuristics, such as 'error prevention' and 'Help and documentation', had more suitable conditions. But in terms of heuristics such as 'flexibility and efficiency of use', there was no suitable situation. It is recommended that the designers of these systems pay attention to the use of usability principles in designing the interface and improving their usability to create a more favorable user experience. In addition, the need to train users in using the systems and increase their information about the benefits and capabilities of these systems is felt to reduce the obstacles to using these systems for users.

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Table 1. Number of problems in terms of Nielsen’s usability heuristics

Nielsen’s heuristics	Electronic learning management systems		
	Navid system	Skyroom	Adobe Connect
	Frequency (%)		
Visibility of system status	3 (13.63)	8 (15.38)	-
Match between system and the real world	2 (9.09)	5 (9.61)	-
User control and freedom	3 (13.63)	10 (19.23)	7 (17.94)
Consistency and standards	1 (4.54)	4 (7.69)	2 (5.12)
Error prevention	-	-	-
Recognition rather than recall	1 (4.54)	3 (5.76)	3 (7.69)
Flexibility and efficiency of use	10 (45.45)	12 (23.07)	8 (20.51)
Aesthetic and minimalist design	2 (9.09)	9 (17.30)	4 (10.25)
Help users recognize, diagnose, and recover from errors	-	1 (1.92)	15 (38.46)
Help and documentation	-	-	-
Total	22 (100)	52 (100)	39 (100)

Table 2. Distribution of problems identified in Nielsen's usability heuristics

Nielsen's heuristics	Problems	Electronic learning management systems		
		Navid system	Skyroom	Adobe Connect
		Frequency (%)		
Visibility of system status	Failure to recognize active options	-	1 (12.5)	-
	Uncertainty whether users are online or offline	-	1 (12.5)	-
	Failure to provide (new) information or system feedback following a user's action	3 (100)	5 (62.5)	-
	Not writing users' roles next to their names	-	1 (12.5)	-
	Total	3 (100)	8 (100)	-
Match between system and the real world	Ambiguity in commands, information, signs and options	2 (100)	3 (60)	-
	Incompatibility of button/option with its symbol	-	2 (40)	-
	Total	2 (100)	5 (100)	-
User control and freedom	It is not possible to enter the class before the operator/teacher enters	-	1 (10)	1 (14.3)
	It is not possible to use the webcam/microphone without asking the operator/teacher	-	1 (10)	1 (14.3)
	The inability to delete messages individually	-	1 (10)	-
	Unable to delete messages	-	1 (10)	1 (14.3)
	Lack of appropriate functional options (buttons) to start system activities	1 (33.3)	5 (50)	3 (42.9)
	Lack of quick access to recorded records and uploaded files	-	-	1 (14.28)
	It is not possible to delete the text from the board with one click	-	1 (10)	-
	Unable to delete attached files	1 (33.3)	-	-
	There is no option to exit the page when the operation is wrong	1 (33.3)	-	-
Total	3 (100)	10 (100)	7 (100)	
Consistency and standards	Using of heterogeneous layout and design to display information and buttons	-	2 (50)	-
	Lack of role change icon for all users	-	1 (25)	-
	Non-use of uniform items that users are used to	-	-	2 (100)
	Absence of search button on all pages	1 (100)	-	-
	Not using different symbols for different options	-	1 (25)	-
	Total	1 (100)	4 (100)	2 (100)
Recognition rather than recall	There was no exit button in the main menu (being in the sub menu)	1 (100)	1 (33.3)	1 (33.3)
	Impossibility of recognizing the use of available buttons according to their labels	-	2 (66.7)	-
	It is difficult to return the teacher to the main page when using the webcam	-	-	1 (33.3)
	Uncertainty of how different options work	-	-	1 (33.3)
	Total	1 (100)	3 (100)	3 (100)
Flexibility and efficiency of use	Disable options	-	1 (8.3)	1 (12.5)
	Lack of proper information	-	1 (8.3)	-
	Need special programs to use the system	-	1 (8.3)	-
	It is difficult and time-consuming to upload and download files	1 (10)	2 (66.7)	-
	Inability to post announcements or messages	-	1 (8.3)	1 (12.5)
	It is not possible to type without using the text box on the board	-	1 (8.3)	-
	Inappropriate performance of options	-	1 (8.3)	-
	Lack of access to comments	-	1 (8.3)	-
	Incompatibility with any type of internet	-	1 (8.3)	1 (12.5)
	The activation of the stop sharing option for all students and the possibility of stopping page sharing for all users	-	1 (8.3)	-
Not deleting the uploaded files after the end of the class	-	1 (8.3)	1 (12.5)	

	Impossibility of writing Farsi correctly	-	-	3 (37.5)
	Difficulty switching between options in full screen view	-	-	1 (12.5)
	The system is not online	1 (10)	-	-
	It is not possible to attach multiple files at the same time	1 (10)	-	-
	It is not possible to delete assignments with answers	1 (10)	-	-
	There is a problem logging into the system	1 (10)	-	-
	Failure to register test results	1 (10)	-	-
	System shutdown while conducting online tests/updating the system	2 (20)	-	-
Flexibility and efficiency of use	Limitation on the size of uploaded files	1 (10)	-	-
	Impossibility of proper two-way feedback	1 (10)	-	-
	Total	10 (100)	12 (100)	8 (100)
	Improper color of the pages	-	1 (11.1)	1 (25)
	Repetition of buttons and icons	-	2 (22.2)	-
	Lack of clarity of shared pages	-	1 (11.1)	-
	Inappropriate board design	-	2 (22.2)	1 (25)
	The difficulty of sharing the entire board	-	1 (11.1)	-
	Unattractive pages	-	1 (11.1)	-
	There are many tab buttons in the system	-	1 (11.1)	-
	Crowded pages	-	-	1 (25)
	Complexity of menus	-	-	1 (25)
	Existence of too much information on the pages	1 (50)	-	-
	The lack of suitable visual icons in the design	1 (50)	-	-
Total	2 (100)	9 (100)	4 (100)	
Help users recognize, diagnose, and recover from errors	Use of inappropriate error message in response to user action	-	1 (100)	14 (93.3)
	Absence of appropriate error message in response to user action	-	-	1 (6.7)
	Total	-	1 (100)	15 (100)

Table 3. Severity ratings of problems identified in electronic learning management system

Severity rating	Electronic learning management systems		
	Navid system	Skyroom	Adobe Connect
	Frequency (%)		
0 (I don't agree)	-	-	-
1 (Cosmetic problem)	-	-	-
2 (Minor problem)	-	10 (19.23)	2 (5.12)
3 (Major problem)	11 (50)	30 (57.69)	17 (43.58)
4 (Catastrophic problem)	11 (50)	12 (23.07)	20 (51.28)
Total	22 (100)	52 (100)	39 (100)

Table 4. Number of problems identified in each part of the system

Part of the system	Electronic learning management systems		
	Navid system	Skyroom	Adobe Connect
	Frequency (%)		
Main page (the whole system)	10 (45.45)	15 (28.84)	20 (51.28)
Users	-	6 (11.53)	1 (2.56)
Chat (Conversations)	2 (9.09)	2 (3.84)	5 (12.82)
Board	-	18 (34.61)	3 (7.69)
Webcam	-	2 (3.84)	1 (2.56)
Desktop sharing	-	3 (5.76)	-
Files (resources)	2 (9.09)	5 (9.61)	2 (5.12)

Login	1 (4.54)	1 (1.92)	1 (2.56)
Q & A	-	-	2 (5.12)
Survey	-	-	1 (2.56)
Video	-	-	1 (2.56)
Notes	-	-	2 (5.12)
Profile of the professor	1 (4.54)	-	-
Previous lessons	2 (9.09)	-	-
Assignments	1 (4.54)	-	-
Communication with supporter	1 (4.54)	-	-
Test	1 (4.54)	-	-
Course management	1 (4.54)	-	-
Total	22 (100)	52 (100)	39 (100)

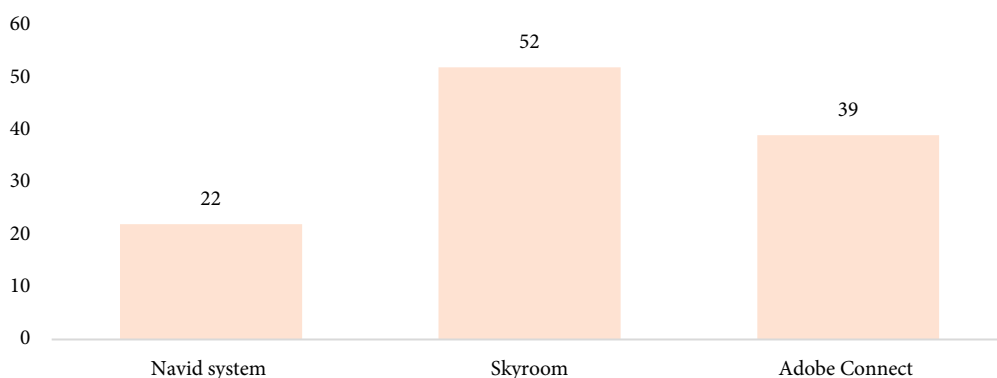


Figure 1. Number of problems identified in each electronic learning management system
 (Due to the repetition of some problems in several systems, the sum of problems in the figure is equal to 113.)

Escape Room, a New Method to Assess the Learning of Nursing Students: A Scoping Review

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Abstract

Background: The escape room game is a very useful and effective learning process used to teach various medical students, including nursing students. Escape rooms are increasingly used in higher education to supplement traditional teaching methods, allowing students to recall and apply knowledge gained in the classroom. In addition, given that the escape room is fun, it encourages them to study.

Objectives: This systematic review aims to investigate the impact of using escape rooms in nursing education and their effectiveness in evaluating students' competencies.

Methods: This scoping review adhered to the PICO systematic review guidelines. The present study is a targeted and integrated review. First, a comprehensive search was conducted using keywords related to "escape room", "nursing education", "assessment", "evaluation" and "student learning" in Elsevier, SID, Magiran, Google Scholar, Science Direct, and PubMed databases to identify relevant studies published between 2010 and 2024. The studies about the effect of escape rooms on the teaching and learning of nursing students were included.

Results: The first search identified 150 articles. After a more detailed review based on the purpose of the current research, 35 articles were included in the second phase of the study. Finally, after reviewing the full text, 10 articles reported the use. These articles' findings have shown that using escape rooms in nursing education improves student participation, teamwork, effective communication, and problem-solving skills. By carefully designing and implementing escape room activities, nursing educators can increase student engagement, teamwork, critical thinking, and problem-solving skills in a fun and interactive way.

Conclusion: This review provides valuable insights into the benefits and potential challenges of incorporating escape rooms into nursing curricula. The immediate feedback and other advantages make escape room training a valuable addition to nursing education. However, it's important to note that more research is needed to fully establish the validity and reliability of using escape rooms as an assessment tool in nursing education.

Keywords: Learning Outcomes; Assessment Methods; Nursing Students; Education

Background

Traditional teaching methods for nursing students usually include lectures and practical demonstrations. These methods effectively teach students the knowledge and skills necessary to become competent nurses. However, these methods may sometimes be repetitive, leading to decreased motivation and interest among students. Also, lecture-based learning methods are

suitable for achieving low-level cognitive goals, but they are not suitable for higher-level education, which includes analysis, evaluation, and synthesis, and requires full participation in learning. (1-3).

Among the games that are growing in the education of medical sciences is Fare's Room, which has been used to train various medical students, including nursing students, in various subjects (4). The new educational

method called escape room offers a unique and interactive approach to learning. Escape rooms have emerged as a popular educational tool in recent years, providing participants with an immersive and interactive learning experience. Escape rooms have rapidly become popular within health professions' education (5, 6).

In this training method, the participants are locked inside a room with a specific goal and a limited time to escape (7). Each escape room has a different background and objective, usually related to finding some object (8). To overcome the escape room, you need to find objects and clues that, through thinking and logic, will help you move forward in the story and open locks and doors to exit the room (9, 10). Since opening the first escape room in Kyoto, Japan, in 2007, escape rooms have become a global phenomenon (9). One of the main advantages of the escape room teaching method is its ability to promote teamwork, critical thinking, problem-solving skills, and communication of knowledge (11). These skills are essential to nursing practice, as nurses often work in fast-paced, high-pressure environments where quick decision-making is critical. Integrating escape rooms into nursing education provides a practical approach to assessing students' clinical reasoning and problem-solving skills (12).

Using the escape rooms allows students to remember and use the knowledge acquired in the classroom. Furthermore, since the escape room is fun, it encourages them to study. In this approach, educators can assess students' ability to apply theoretical knowledge in practical settings by immersing them in simulated patient care scenarios (13). Moreover, considering the high importance of hands-on experience in nursing, it is crucial to thoroughly evaluate educational activities; with the feedback received, necessary changes can be made to the academic program (curriculum) (14).

Objectives

The study aimed to investigate the outcomes of utilizing escape rooms as a novel educational approach in nursing student education and to assess their efficacy.

Methods

Selected reporting items for systematic reviews and meta-analyses for scoping reviews (PRISMA-ScR) were followed as the methodology and reporting in this study (Diagram 1).

To find the most reliable information, it is crucial to seek the best available evidence in the shortest time possible. Therefore, utilizing the best guidelines (PICO)

is crucial. The Table 1 illustrates the research methodology (15).

Search Strategy and Eligibility Criteria

A systematic search was conducted in electronic databases, including Elsevier, SID, Magiran, Google Scholar, Science Direct, and PubMed, to identify relevant studies published between 2010 and 2023. The search strategy included keywords related to "escape room," "nursing education," "assessment," "evaluation" and "student learning." Certain factors, such as publication date, study design, and focus on educational outcomes were selected. Data extraction included the identification of key variables such as sample size, study setting, outcome measures, and conclusions regarding the use of escape rooms in nursing education. Analysis was performed by combining findings across studies to identify common themes and outcome variations.

Study Selection and Data Extraction

Inclusion criteria were external studies that evaluated the use of escape rooms to assess nursing student learning outcomes. A total of 10 studies met the inclusion criteria and were included in the final analysis. In terms of article type, clinical trial, review, and cross-sectional articles were included, which are listed separately in Table 2. Case reports and studies with a sample size of less than 15 were excluded from the study. Data from different databases were entered into EndNote X8 software, and duplicate entries were removed. The full text of the articles was reviewed. The data collection process included the use of Excel software. Data collected for each article included information such as authors, publication years, title or purpose of the research, results, and other relevant details. Inclusion criteria were studies that evaluated the use of escape rooms as a method to assess nursing student learning outcomes.

The search strategy included keywords related to escape rooms as a new educational method, nursing, students, education, assessment methods, and learning outcomes. Studies that met the inclusion criteria and provided valuable insight into using escape rooms as an assessment method in nursing education were finalized in an independent screening process.

Results

Extracting the data: Data related to studies (such as author, year, and study design), participant details (demographics), escape room intervention details (design, objectives), and evaluation methods used were extracted. Following a systematic approach to study selection and data extraction, this extensive

methodology warranted a comprehensive literature review of escape rooms as a new assessment method in nursing education (Table 2).

Discussion

This study was conducted to review the effectiveness of the escape room in evaluating nursing students' learning. After a comprehensive review of the articles, ten studies in different cultures and ethnicities were included according to the mentioned keywords. Escape rooms provide a unique and immersive learning experience that simulates real-world scenarios and challenges, making them an attractive option for assessing the knowledge and skills of nursing students (25). Gamification has been gaining momentum in medical and health science education around the world, with studies showing that educational gaming stimulates students' engagement and persistence on tasks, which in turn enhances deep learning. By placing students in a simulated environment where they must work together to solve puzzles and complete tasks under time constraints, escape rooms can provide valuable insights into their use in applying theoretical knowledge in practical situations. Additionally, the collaborative nature of escape rooms promotes communication and teamwork skills that are essential for effective nursing practice (26-30).

Escape room training can be more effective in the clinical education of nursing students than traditional methods for several reasons. Escape rooms provide a hands-on and immersive learning experience that allows nursing students to develop their knowledge and skills. Utilizing a realistic and attractive environment, this practical experience can help students develop confidence and competence in clinical practice and strengthen critical thinking and decision-making skills by asking students to think critically, solve problems, and make decisions under pressure in escape rooms. These skills are essential in nursing practice, where quick thinking and problem-solving abilities are critical to providing safe and effective patient care. The escape room creates teamwork and is effective in establishing communication. Nursing is a collaborative profession that requires teamwork and effective communication skills. Escape rooms promote teamwork, collaboration, and student communication as they work together to solve puzzles and challenges. These skills are critical to successful patient care in clinical settings. Escape rooms often simulate real-world scenarios that nursing students may encounter in clinical practice. By experiencing these scenarios in a controlled environment, students can better

prepare for the challenges they may face in their future nursing careers (31-33).

However, there are challenges in using escape rooms to train nursing students.

Using escape rooms in nursing education raises several ethical considerations that must be addressed. For example, ensuring that the scenarios presented in the escape room are aligned with the educational objectives of the nursing program is critical to maintaining the integrity and validity of the assessment (34). Additionally, it is important to consider the emotional and psychological impact of escape room challenges on students, especially those who may struggle with stress or anxiety. Besides, funding is essential when implementing escape rooms as an assessment tool in nursing education. Developing and maintaining escape rooms requires financial resources to design scenarios, purchase materials, and create physical space. Funding from institutional sources, grants, or partnerships with industry stakeholders may be necessary to support the continued use of escape rooms as an assessment method. Assessing student learning outcomes in an escape room environment can be challenging. It may be difficult to measure student performance or assess specific learning objectives within an escape room scenario (35).

Integrating escape rooms into the nursing curriculum requires careful planning to ensure that activities are aligned with learning objectives and complement other teaching methods. Nursing educators may face challenges creating and maintaining escape rooms, especially in busy academic environments. Educators must balance escape rooms with traditional teaching approaches to create a holistic learning experience. While escape rooms offer unique advantages for teaching nursing students, educators should be aware of the challenges and limitations associated with this method (36). Nurses are central health care providers with extensive patient interaction that makes their work performance critical (37). By carefully designing and implementing escape room activities, nursing educators can increase student participation, teamwork, critical thinking, and problem-solving skills in a fun and interactive way. Generally, learning and remembering are two important principles in nurses' career process and should be considered in modern teaching methods such as escape rooms or The Café Model is an innovative, interactive teaching method designed to enhance the learning experience for nursing students that are suitable and practical. Still, the use of these methods is not approved in every group.

Therefore, using modern teaching methods to train nurses requires many studies and research (38-40).

Limitation: Potential limitations of this review are that some studies could not be identified because of access issues and that some studies included participants other than nursing students.

Conclusion

The findings revealed key points about using escape rooms to assess nursing students' learning. These include improved levels of student engagement, increased teamwork abilities, increased motivation to learn complex concepts, and higher levels of satisfaction with the assessment process among students and instructors. Additionally, studies have demonstrated that escape rooms provide a challenging yet rewarding experience for nursing students, allowing them to demonstrate their knowledge and skills in a real-world setting. The collaborative nature of escape room activities fosters teamwork and communication among students and enhances their ability to work effectively in clinical settings. Experiential learning theory believes that people learn best through direct experience and reflection on that experience. In the context of nursing education, practical activities requiring problem-solving skills can enhance student learning outcomes. Escape rooms provide opportunities to engage in real-life scenarios where students must apply their knowledge. Collaboratively solving problems in a time-limited environment aligns with active learning theories. It enhances critical thinking skills for nursing practice.

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Table 1. Research Question Design (PICO)

Population (P)	Intervention (I)	Control (C)	Outcome (O)
Nursing students	Escape room, a new method to assess the learning	Traditional Learning	The effect of using the escape room educational method on the learning rate of students

Table 2. Summary of the articles conducted in the field of the escape room's effects to evaluate nursing students' learning

The responsible author of the Research and the publication date	Title	Intervention	Type of study	Participants	Results
Martin A 2022 (16)	An escape room to orient preclinical medical students to the simulated medical environment	A 90 activity A minute to learn pre-clinical skills in the escape room was designed and implemented to reduce students' anxiety	Interventional	This research was performed on 148 second-year medical students. Sampling was done by census method.	Based on this study, the researchers stated that playing the escape room game for pre-clinical medical students is effective and useful in preparing them to participate in the first simulated medical environment scenario.
Reed JM 2021 (17)	Gaming and anxiety in the nursing simulation lab: A pilot study of an escape room. Journal of Professional Nursing	In the beginning, the nursing professors explained to the students about the expectations, mannequins, and equipment in the room for ten minutes. The students were given an anxiety questionnaire, and the students received the rules and goals of the game along with the patient's written report.	This research is a semi-experimental study of a group with a pre-test-post-test, in which sampling was done by the available method.	Nursing students	This study noted increased collective efficacy among participants, indicating increased teamwork skills.
P Roman, M Rodriguez-Arrastia 2020 (18)	Escape room as an evaluation method: a qualitative study of nursing student experiences	The OSCE, in combination with the Escape Room, lasting a maximum of 30 minutes, consisted of a group assessment (5 participants) in which they were confronted with various stations, which included different clinical cases, part of one entire case with the same.	Interventional	In January 2019, 9 focus groups (FG) were held, with 95 final-year nursing students. We applied qualitative content	Based on the results of this study, it can be concluded that the use of the escape room helps, along with other pre-existing methods, and complements how students are evaluated and the development of essential nursing skills such as teamwork and communication
L Gutiérrez-Puertas, VV Márquez-Hernández 2020 (19)	Escape rooms as a clinical assessment method for nursing students	Tools used: • Game experience scale (GAMEX) to measure students' game experience. • Case scale to measure students' satisfaction with the escape room as an evaluation tool	Quasi-experimental with an experimental group (escape room) and control group (traditional OSCE).	Participants: 237 nursing students were randomly divided into two groups.	The results of this study showed that escape rooms are a valuable tool for evaluating 12th-grade nursing students compared to the use of objective structured clinical assessment.
ER Millsaps, AK Swihart 2022 (20)	Time is brain: using escape rooms as an alternative teaching assignment in undergraduate nursing education	Students completed a pre-class worksheet, participated in an escape room, and then participated in a debriefing using the GAS (gather, analyze, summarize) model.	Interventional	Twenty-four students completed this escape room experience.	According to the findings of this study, escape room experiences can be used in the preparation for nursing associate degree

Li C-T, Huang Y-J (21)	Designing an escape room educational game for cardiopulmonary resuscitation training	In this study, the escape room was designed as a computer game called "Silent Hill", in which a student suffered a cardiac arrest in the story of the game, and the students participating in the game had to answer various questions related to cardiac resuscitation and solve the riddles of the room.	This research was a semi-experimental	The study was conducted on 38 junior high school students in northern Taiwan. Sampling was done by the census method	Based on the results of this study, children's themed escape rooms are an innovative educational method to integrate into your curriculum
Urquiza, C HuesoMontoro 2022 (10)	Nursing students' experience using an escape room to teach clinical skills and competencies in emergency care: a qualitative observational study	This study explored nursing students' experiences using an escape room as a game-based learning tool to teach clinical skills and competencies in emergency care. This study lacked a control group that could provide comparative insight into the effectiveness of traditional learning methods versus game-based learning.	A qualitative, observational study was carried out.	The sample was intentionally selected from the students who participated in the escape room (n = 105) developed for the subject Adult	Based on this study, the use of an escape room to evaluate the knowledge of nursing students is a practical approach
L Moore, N Campbell 2021 (22)	Effectiveness of an escape room for undergraduate interprofessional learning: a mixed method, single-group pre-post-group evaluation.	A pre-post one-group mixed design was used to evaluate the effect of the escape room on student engagement and learning. The intervention consisted of an escape room activity and an interactive training session.	Interventional	Fifty students (78% female) from seventeen universities and seven professions participated in teams of three to six members. Most participants (66%) had not previously completed an escape room	In this study, the escape room intervention added value to the curriculum and was flexible for a heterogeneous student group.
A Anguas-Gracia, AB Subiron-Valera 2021 (23)	Evaluation of undergraduate student nurses' playful experiences while playing an escape room game as part of a community health nursing course.	The escape room game occurred in a Faculty of Health Sciences classroom. The measures included the GAMEX scale in its Spanish version and a self-reported questionnaire to evaluate the student's outcome of the escape room game immediately After the end of the activity.	This study was a cross-sectional descriptive study	Participation of 126 third-year nursing students.	Based on the results of this study, gamification in general, and escape rooms in particular, has been proven authentic tools for acquiring professional competencies in higher education.
Emine Kuruca Ozdemir2022 (24)	Game-based learning in undergraduate nursing education: A systematic review of mixed studies	A search was conducted using Medline, PubMed, Science Direct, Scopus, and Web of Science electronic databases. Quantitative, qualitative, and mixed methods studies on nurse education published in English between 2000 and 2020 were considered.	A systematic review of mixed-methods studies.		Based on the results of this study, game-based learning is a valuable method to achieve learning outcomes, mainly in the cognitive domain, with some positive and negative aspects. Further research should examine the effects of games on emotional and behavioral learning outcomes and the use of games to assess learning outcomes.

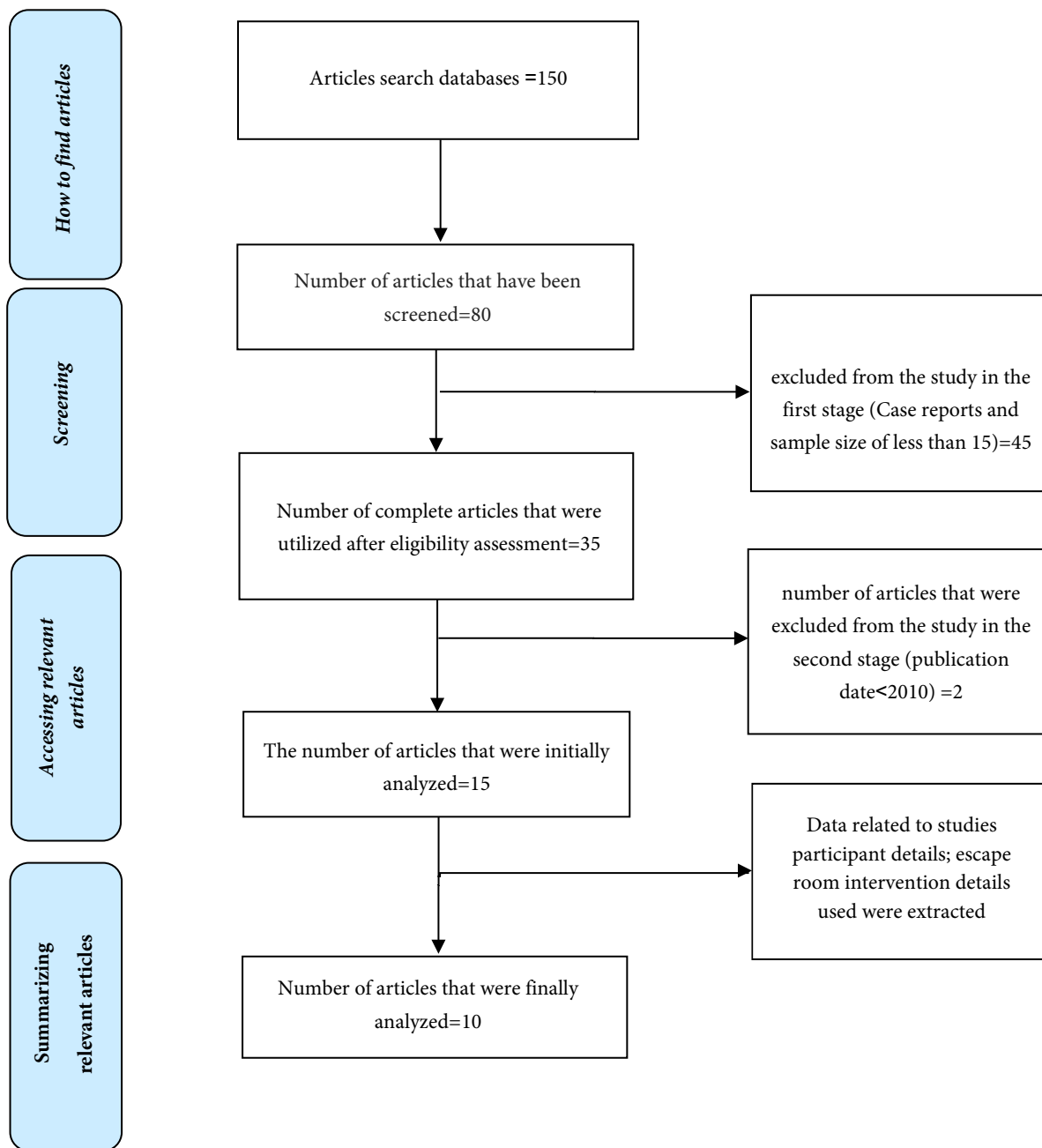


Diagram 1: Flowchart of screening and selection of articles

Explaining the Experiences of Students and Graduates during Internship Courses in the Field of Healthcare Service Management: A Qualitative Study

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Abstract

Background: The present study was designed and implemented to explain the experiences of students and graduates during internship courses in the field of healthcare service management.

Objectives: The present research adopted a qualitative approach to gain a more comprehensive understanding of the challenges and opportunities in educational and healthcare settings.

Methods: This qualitative study employed content analysis and purposive sampling on students and graduates in the field of healthcare service management at Bam University of Medical Sciences. Data were collected through semi-structured interviews and analyzed using Braun and Clarke's thematic analysis.

Results: The findings were categorized into two main categories: Curriculum planning curriculum planning opportunities and challenges. Curriculum planning opportunities consisted of "curriculum planning, communication with professors, and evaluation," while curriculum planning challenges consisted of "internship field staff, professors, logbooks, welfare facilities, and lesson plan."

Conclusion: The curriculum planning for internship courses has strengths that help enhance the quality of education and students' professional skills. However, several challenges were identified that could hinder the achievement of educational objectives. In order to mitigate these challenges, taking various measures seems necessary, including training courses for staff, providing ongoing feedback, reviewing logbooks, clarifying learning objectives, and fostering interdepartmental collaboration at a higher organizational level.

Keywords: Education; University Medical Science Education Centers; Students of Healthcare Service Management; Qualitative Research; Iran

Background

Healthcare service management is a pivotal discipline in the healthcare field. As public awareness and expectations enhance, the healthcare system must take influential measures to achieve its goals. The nurture of specialized human resources, particularly in the field of healthcare service management, plays a crucial role in this process. This field of study was first established in 1934 at the University of Chicago in the United States and was introduced in Iran at the University of Tehran in 1956 (1).

Healthcare service management focuses on the management of health, treatment, and medical education and aims to nurture competent professionals

to improve health services in the areas of management, policymaking, and health economics (2). Theoretical and practical training, along with internship courses, help students to apply the learned concepts in practice (3). The purpose of internship courses is to provide practical acquaintance with various components of the healthcare network and to acquire professional skills because theoretical knowledge alone is not sufficient and there may be a gap between theory and practice (4). Proper and timely training through internship courses helps prevent the nurture of unprofessional human resources and improve practical skills (5-7).

By attending internship courses, students serve as valuable resources for identifying shortcomings and

challenges within the healthcare system (5, 8). Their practical training and skill development should be a focus of attention and evaluation (5). The constantly evolving needs of the healthcare sector necessitate continuous updates and improvements to curricular and educational programs (4). In line with these findings, Tebrizi et al.'s study demonstrated that students encountered difficulties in acquiring the necessary skills during internship courses and expressed a desire for improved educational processes (5). Additionally, Ghaffari and Davari Dowlatabadi's study investigated the challenges of internship courses in three areas: Professors, fields, and logbooks (8).

Although there are some quantitative studies on the status of internship courses in the field of healthcare service management, they were unable to deeply explore the students' experiences and feelings (9, 10). Thus, the present research adopted a qualitative approach to gain a more comprehensive understanding of the challenges and opportunities in educational and healthcare settings. Considering the complex and context-dependent nature of this topic, a thorough examination of various dimensions is necessary. Consequently, this research was conducted to investigate the experiences of students and graduates during internship courses at Bam University of Medical Sciences.

Objectives

The present research adopted a qualitative approach to gain a more comprehensive understanding of the challenges and opportunities in educational and healthcare settings.

Methods

This qualitative research, conducted in 2023, employed content analysis to investigate the experiences of students and graduates in the field of healthcare service management. Participants were selected purposefully and interviews were carried out with students who had completed at least one internship course. Furthermore, interviews were conducted both in-person and online after obtaining informed consent using semi-structured questions. Interview duration ranged from 40 to 60 minutes, and data saturation was reached after 20 interviews. Data were analyzed using Braun and Clarke's thematic analysis (9). Then, the research team extracted and interpreted meaningful patterns by repeatedly reviewing interviews and coding and categorizing themes. In order to ensure the credibility of the findings, research documentation was

maintained throughout all stages, and team efforts were employed to assess the quality and reliability of the results.

Results

The findings of the current research were categorized into two main categories: Curriculum planning opportunities and curriculum planning challenges. Each of these categories had main themes and subthemes (Table 1).

including the subtheme of "appropriate semester-based scheduling."

Appropriate Semester-Based Scheduling: Appropriate semester-based scheduling should contribute to students' satisfaction with the sequence of courses, particularly internship courses, within the Healthcare Service Management Department. Internship courses should commence from the fourth semester, after the theoretical courses, to enable students to enter the practical field with a more comprehensive perspective.

Additionally, by covering various levels of the healthcare system, these courses prepare students to better understand real-world needs and challenges and make informed decisions as future managers. In this regard, one student stated, "*Its strength lies in its arrangement based on the hierarchy of service provision; i.e., it starts from the bottom and moves up... from health centers at hospitals and then to central offices.*" (Participant 9)

Another student commented, "*The semester-based scheduling is very good; first, you learn the theory and then you go for an internship.*" (Participant 10)

2. Communication with Professors: This theme examines participants' perspectives on internship professors and consists of the subtheme of "professors' comprehensive and thorough planning and responsiveness to students."

Professors' Comprehensive and Thorough Planning and Responsiveness to Students: Participants mentioned that most internship professors were adept at answering their questions and elevated students' productivity and motivation through detailed planning and collaboration. One participant stated, "*Professors visit all departments daily, take the time to address our challenges, and provide explanations when we have questions.*" (Participant 8)

Another participant commented, "*The internship program is very precise and complete. Everything is clearly outlined day by day, which helps prevent*

confusion. We know the daily schedule from the beginning of the semester.” (Participant 1)

3. Evaluation: This theme delves into participants’ experiences with internship course evaluations and includes the subtheme of “appropriate evaluation using logbooks.”

Appropriate Evaluation Using Logbooks: This subtheme explores the method of evaluating internship

courses, which is carried out based on a completed logbook provided to students at the beginning of the semester. Some participants believe that the logbook helps students’ activities be targeted. One participant stated, “*The strength of the logbook is that it gives students a clear overview of what they should be looking for.*” (Participant 8)

Table 1. Curriculum planning opportunities and challenges

Primary Category	Main Theme	Subtheme
Curriculum planning opportunities	Curriculum planning	Appropriate semester-based schedule
	Communication with professors	Professors’ comprehensive and thorough planning and responsiveness to students
	Evaluation	Appropriate evaluation using logbooks
Curriculum planning challenges	Challenges related to internship field staff	Staff limited awareness of collaboration with students Staff unawareness of the healthcare service management field position
	Challenges related to internship professors	Lack of mid-term evaluations Lack of face-to-face introductions of students to staff by professors
	Challenges related to logbooks	Lack of dynamism and clarity in logbook content
	Challenges related to welfare facilities	Insufficient attention to students’ transportation and dressing rooms
	Challenges related to lesson plans	Unclear learning objectives for students Incompleteness of the internship shift scheduling

A) Curriculum Planning Opportunities

This category encompasses three main themes and three subthemes.

1. Curriculum Planning: This theme delves into the strengths related to internship curriculum planning,

B) Curriculum Planning Challenges

This primary category includes five main themes and eight subthemes.

1. Challenges Related to Internship Field Staff: Despite significant student interaction with staff, challenges exist in this area. Two subthemes include “staff limited awareness of collaboration with students” and “staff unawareness of the healthcare service management field position.”

Staff Limited Awareness of Collaboration with Students: One of the obvious responsibilities of staff in medical universities is to educate students. However, it seems that some staff members are not fully aware of this responsibility, culminating in decreasing students’ motivation to complete internship courses. One participant stated, “*Some staff members are not even aware that one of their duties is to teach and collaborate with students.*” (Participant 11)

Staff Unawareness of the Healthcare Service Management Field Position: Some participants mentioned that certain staff lack sufficient knowledge about this field of study and mistakenly believe that medical university students are only medical students. Consequently, they are less inclined to collaborate with students from this field. One participant stated, “*They do not recognize the position of the management field of study and prefer to collaborate mostly with clinical disciplines. It would be better if someone could convince the staff to also value management students.*” (Participant 2)

2. Challenges Related to Internship Professors: Regarding this main theme, it is worth noting that professors play a pivotal role in teaching and learning. Identifying the related challenges is essential for improving the objectives of internship courses. Two identified subthemes for this theme include “lack of mid-term evaluations” and “lack of face-to-face introductions of students to staff by professors.”

Lack of Mid-Term Evaluations: Focusing solely on final evaluations can negatively impact student performance. Continuous evaluation and feedback throughout the internship course contribute to learning

and provide opportunities to compensate for learning. One interviewee stated, “*Mid-term evaluations can increase student activity and reduce end-of-term pressure.*” (Participant 10)

Lack of Face-to-Face Introductions of Students to Staff by Professors: Some participants mentioned that students sometimes face rejection from internship field staff. This issue may arise from the lack of face-to-face introductions of students to staff at the beginning of the internship course. One participant stated: “*The cooperation of staff is not good until the professor comes and talks to them.*” (Participant 6)

3. Challenges Related to Logbooks: In this main theme, although many participants expressed satisfaction, some pointed out problems with the content of logbooks. These problems included “lack of dynamism and clarity in the logbook content.”

Lack of Dynamism and Clarity in Logbook Content: The lack of dynamism and clarity refers to the presence of technical jargon, general questions, and inattention to details, which staff are unable to properly comprehend. One interviewee pointed out, “*A major drawback of the logbook is the generality of its questions*” and suggested that “*questions should be more specific and technical.*” (Participant 5)

4. Challenges Related to Welfare Facilities: This main theme highlights the need for adequate welfare facilities to carry out internship courses more effectively. Students believed that existing problems with welfare facilities caused distress and reduced the quality of learning, including the subtheme of “insufficient attention to students’ transportation and dressing rooms.”

Insufficient Attention to Students’ Transportation and Dressing Rooms: Some participants pointed out the lack of coordination between the transportation service schedule and the internship hours, causing problems. Students, who in addition to internship courses, also take theoretical courses, face the situation of having internship courses in the morning and theoretical classes in the afternoon, leading to fatigue and reduced efficiency. Many students stated that no attention was paid to the time interval between the internship and the classes. A student stated, “*We have to wait until 12:40 and the service takes us to the campus at 1:30; we cannot even have lunch.*” (Participant 10)

Other challenges include “the lack of transportation service for local students” and “the lack of a dressing room at the hospital.”

5. Challenges Related to Lesson Plans: This main theme refers to the lesson plan, which is considered the overall roadmap for education. An inadequate lesson plan can hinder the achievement of the primary objectives of internship courses. The subthemes of this main theme encompass “unclear learning objectives for students” and “incompleteness of the internship shift scheduling.”

Unclear Learning Objectives for Students: This subtheme indicates that some students, despite professors’ explanations during the orientation session, are confused about the internship learning objectives. One of them said, “*The professor explained them in the orientation session, but we get confused in the field... Maybe the staff members cause such confusion.*” (Participant 4)

Incompleteness of the Internship Shift Scheduling: In this subtheme, some interviewees believed that students should also be familiar with evening and night shifts, as hospitals operate 24 hours a day. “*We should also pay attention to the challenges of evening and night shifts.*” (Participant 7)

Discussion

The present research explored the experiences of students and graduates in healthcare service management at Bam University of Medical Sciences regarding their internship course credits. The findings included two primary categories (curriculum planning opportunities and curriculum planning challenges) and eight themes. In the curriculum planning opportunities category, the main themes encompassed “curriculum planning, communication with professors, and evaluation.” Participants positively evaluated the semester-based planning, professors’ responsiveness, and evaluation using logbooks. In this regard, the findings of Gottschalk et al.’s study demonstrated that appropriate planning and professors’ responsiveness contributed to improved student performance (10). According to the results of Omer’s research, logbooks are beneficial for learning; however, more careful monitoring by professors can increase their effectiveness (11).

In the curriculum planning challenges category, the main themes identified were “challenges related to field staff, challenges related to professors, challenges related to logbooks, challenges related to welfare facilities, and challenges related to lesson plans. Participants pointed to problems with staff and their unawareness of the healthcare service management field, which aligns with

the findings of Remmen et al.'s research highlighting the lack of orientation for hospital staff (12). Furthermore, in Bordbar et al.'s study, the lack of cooperation from staff and their low motivation to teach were mentioned (13). Additionally, Nourouzi et al. assessed the students' intrinsic motivation and identified poor staff cooperation during internship courses as a factor reducing students' intrinsic motivation (14). The results of Kohan and Keshmiri's study revealed that due to supervisors' busy schedules and their unfamiliarity with the trainees' educational needs, along with the limited time students have in departments, answering all questions and becoming sufficiently familiar with departments was not performed properly (15). Moreover, Griffin and Baverstock's study reported inappropriate behavior, discrimination, and lack of cooperation from internship staff as major challenges in this area (16).

Another challenge is related to problems with internship professors, which include "lack of mid-term evaluations and lack of face-to-face introductions of students to staff by professors." Some participants believed that mid-term evaluations could help improve student performance. The results of Seligman et al.'s research demonstrated that continuous evaluation and feedback every two weeks had a positive impact on student performance (17). According to Augusto et al.'s research, the presence of competent and enthusiastic professors in internship fields contributes to student success and the effectiveness of discussions (18). Sultan Althaqafi et al.'s study also highlighted the quality of mentoring provided (19). Another challenge is related to problems with logbooks. Some participants pointed to the lack of dynamism and clarity in logbook content. As demonstrated by Babadi et al.'s research, the use of logbooks in internship courses is important, but appropriate content and the correct design of logbooks are among influential factors (20).

Challenges related to welfare facilities were another identified problem. Some participants pointed out the limited availability of welfare facilities, such as the lack of dressing rooms and difficulties in coordinating transportation services. The findings of Ahmadi et al.'s research revealed that welfare facilities had a significant impact on students' motivation and performance in internship courses, and students were dissatisfied with rest areas (21). The final challenge identified was related to problems with the lesson plans. Some participants believed that the multifaceted nature of activities in the

internship course caused them confusion, while others suggested the presence of students in evening and night shifts. The findings of Tabrizi et al.'s study showed that the absence of a clear lesson plan was one of the root problems of internship courses in the healthcare service management field (22).

Limitations: This research was limited to Bam University of Medical Sciences. Therefore, there may be other challenges and strengths from the perspectives of students in other universities and regions that should be considered when utilizing the results.

Conclusion

The current qualitative study aimed to investigate the experiences of students and graduates in healthcare service management during their internship courses. The findings revealed that opportunities provided students with a comprehensive and systematic perspective and familiarized them with real-world needs of society and challenges in the healthcare sector. Thus, educational policymakers and decision-makers can employ these strengths to enrich internship courses. Numerous challenges were identified in the planning and implementation of internship courses, hindering the achievement of educational goals. In order to mitigate these challenges, the following recommendations are proposed: Holding training courses for field staff to enhance their awareness of their responsibilities and the importance of collaborating with students; implementing mid-term evaluations and providing ongoing feedback to students to improve learning; reviewing and updating logbooks with a focus on details and technical questions; providing adequate welfare facilities, such as providing transportation services coordinated with internship course hours and appropriate dressing rooms; and providing more precise explanations of learning objectives and lesson plans to students and ensuring their full comprehension.

The aforementioned actions can contribute to improving the quality of internship courses and better prepare students for managerial roles in healthcare. Some challenges require interdepartmental collaboration at the level of various university vice-chancellors. Hence, it is recommended that joint meetings be held to develop operational protocols and strengthen interdepartmental collaboration.

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Determining the Training Requirements of Disaster Medical Assistance Teams (DMATs) in Iran; A Novel Approach

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Abstract

Background: Empowering and improving the preparedness of DMATs plays a vital role in the effectiveness of the medical relief process. Integrated training of rapid response teams is a significant goal to promote coordination in the response phase. Determining educational requirements is an essential prerequisite for developing educational programs.

Objectives: This study was conducted to determine the training requirements of Disaster Medical Assistant Teams (DMATs) in Iran.

Methods: This mixed methods study was conducted in 3 steps. In the first step, the roles and duties of DMATs were identified using a narrative review. Then, training requirements were determined using a focused group discussion method. Finally, the three-round Delphi survey was used to finalize the study's findings in the third step.

Results: Using a narrative review of the texts from 2428 articles, 15 addressed the roles and duties of DMATs and were included in the study as final texts. The roles and duties of the health, treatment, and support teams, as well as the team managers and seniors, were identified. In the second step, based on expert opinions in FGD, 105 specific and 16 general training requirements were found. The findings of this step were entered into the Delphi for finalization. Finally, the training requirements of DMAT members were determined. These requirements are divided into specific and general requirements.

Conclusion: DMATs are an integral part of disaster response operations, and their actions can play a vital role in the success of disaster response. On the other hand, DMAT members usually work individually in healthcare jobs and join each other as a team, depending on emergency conditions. Therefore, they need continuous training to perform their duties. The findings of this study can be a starting point for the training program of DMATs because, in addition to showing the roles and duties of the teams and sub-teams in disasters, it specifies the necessary skills and training requirements of the members.

Keywords: Disaster Medical Assistance Teams (DMAT); Roles and Duties; Training Requirements

Background

Disasters have killed millions of people and caused significant financial problems. Facing natural phenomena has always been the primary concern of human beings, from the time the early men started their

lives inside caves to the new era when people dwell in their modern and advanced structures (1). Disaster is a complete or partial cessation of a group or community's activities that leads to casualties, material damage, and environmental damage that the community cannot

compensate for with its existing resources (2). Nowadays, disasters and accidents account for a large portion of government resources and programs. The news carries daily information about various accidents worldwide. Climate change, human manipulation, and the rapid growth of technology have increased people's vulnerability (3).

Health has a special place among all the elements involved in disaster management because it is people's first and foremost demand and concern (4). Health plays a role in meeting people's needs in various ways. The health system's objective in disasters and emergencies is to deliver prompt medical care to stop the deaths and disabilities of affected people (5). The fourth priority for disaster risk reduction mentioned in the 2030–2015 Sendai framework is "increasing preparedness to provide an effective response to the effects of disasters at all national, local, and regional levels," emphasizing the provision of effective health and medical services in disasters (6). Strengthening local medical response capability through preparation, practice, and lesson learning is one suitable approach to achieving the objectives outlined in the aforementioned priority (7). One action taken by the health systems of several countries to improve their capacity to respond to disasters' consequences has been the development of Disaster Medical Assistant Teams (DMATs). These teams comprise medical professionals, including nurses, midwives, emergency medical technicians, general practitioners, specialists, and logisticians (8). These staff are dispatched to places where the healthcare system has been destroyed or overwhelmed and lacks the capacity and capability to deliver healthcare services (9). According to experience, the most efficient method to lessen the effects of disasters is to create and develop agile and multidisciplinary teams with proper training, exercises, and particular management strategies before disasters and emergencies occur (10).

Empowering and improving the preparedness of DMATs plays a vital role in the effectiveness of the medical relief process. Training is one of the most critical components in developing DMAT preparedness and empowerment. For a group of people who have yet to work together daily, staying together, working together, and providing high-quality services requires ongoing training (11). On the other hand, getting to know colleagues, doing team activities, working with equipment, etc., increases familiarity and empathy between team members and can lead to increased cooperation and coordination in an emergency.

Training includes classroom programs, on-site training, and workshops. Training can guarantee that the team members will act according to the unit instructions in line with their tasks and that errors will likely be reduced (12). The training should focus on the teams' roles and duties, which is the most crucial aspect of preparedness. Otherwise, it could result in resource waste (13).

Iran is a developing country in the Middle East, where numerous natural and artificial events have occurred in the last few decades. In 2003, the Bam earthquake killed more than 26,000 people. After that, several other earthquakes (Zarand, Borujerd, Kermanshah, Varzeghan, Khoi, etc.) led to many financial and human losses. In recent years, due to weather events, more than 70% of Iran's people have been affected by floods and storms (14). As a result, due to the human losses caused by disasters and their effects on the delivery of health services, the emphasis of Iran's disaster management program is health (15). Recent research and experience in responding to medical requirements caused by disasters revealed that teams of medical experts would go to disaster-affected areas voluntarily or as part of their job duties (16). In a study conducted by Tavan et al. in Iran regarding the risks threatening the participants in mass gatherings, it was pointed out that the DMATs could not perform appropriately in the incidents because they did not have proper training. In addition, a coordination challenge was observed among the teams. In this study, the lack of specific roles and tasks for teams is pointed out as one of the reasons for inconsistency (17, 18). In his research, Sorani et al. state that pre-hospital measures have faced many challenges in various incidents in Iran in the last decade. One challenge is changing the composition of DMATs to 4-member teams, which has led to parallel work and interference with some tasks. Another challenge is how to select and train members of the DMATs, which has reduced the efficiency and effectiveness of pre-hospital activities. In addition, the lack of training programs has been identified as another reason for the ineffectiveness of DMATs (19).

Objectives

This study was conducted to determine the training requirements of Disaster Medical Assistant Teams (DMATs) in Iran.

Methods

This mixed-methods study was conducted in three steps, which are shown in Figure 1. In the first step, due

to the lack of clear roles and duties for the teams in Iran, this study sought to identify the roles and duties of DMAT teams by raising a question. For this purpose, a narrative review was performed in the databases based on the guidelines of Baumeister et al. (20).

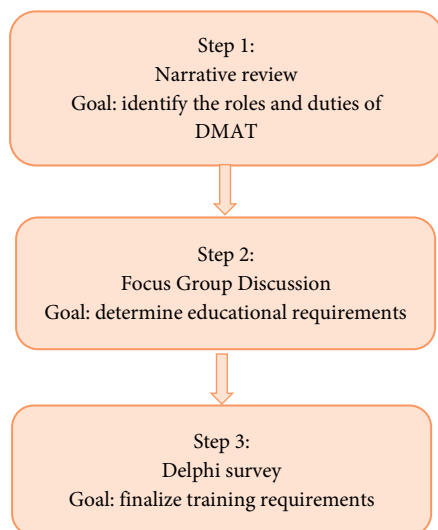


Figure 1. Study steps

The research question in the first phase of the study was as follows:

What are the roles and duties of DMAT teams?

The search strategy and keywords were selected based on the study's objectives and research question, with the opinion of experts and study partners. The search strategy is in Appendix 1. Pubmed, Scopus, Web of Science, and Google Scholar databases were searched until July 2022. Among the texts found, articles that specifically addressed the roles and tasks of the teams were selected. Articles were included for review if they met the following criteria: (1) published in English; (2) published until June 2022; and (3) original articles and conference papers. A systematic review, letters to the editor, editorials, and articles that did not attempt to investigate the roles and duties of DMATs were excluded from the study. Qualitative and quantitative CASP tools were used to evaluate the quality of articles. Direct content analysis of articles was used to extract the roles and duties of DMATs. Using this method, the full text of the articles was reviewed, and the roles and duties that were directly mentioned were selected for each team. Finally, duplicate roles were removed, and similar roles were merged. To achieve validity and reliability, the study was conducted by two independent researchers and then reviewed by a third person. The

data from this phase was used as a guideline for the second stage of the research. This table was provided to the participants in the focus group discussion in the second stage of the study to determine the educational requirements. The aim was to determine the training needs based on the roles and tasks of the teams. In this way, unnecessary or repetitive cases were avoided.

In the second step, a focus group discussion (FGD) was conducted to determine educational requirements. The meeting lasted 150 minutes. One person managed the meeting as a facilitator. First, the study and meeting objectives were explained to the participants. In this meeting, the findings of the first stage were presented to the participants. The facilitator reviewed the roles and duties of each DMAT team and asked the participants' opinions about the type of skills and training requirements. The meeting was recorded entirely, and the project executors made notes during the meeting. The inclusion criteria in FGD were at least five years of experience in medical education, experience membership in DMATs, familiarity with disasters and how to provide relief, and interest in the subject.

The meeting was held in September 2022 with 14 experts in various fields. The characteristics of the participants in the FGD are shown in Appendix 2. Finally, the meeting video was reviewed, and all its content was transcribed and entered into MAXQDA Ver 2020 software for content analysis. According to the research objectives, the categorical content analysis method was used. In this way and based on the questions raised in the FGD, the findings of this stage were classified as the educational requirements of DMAT members in the form of general and specific skills. The research team evaluated the findings twice to identify all the cases.

After FGD, the three-round Delphi survey was used in the third step to finalize training requirements. 25 knowledgeable and experienced specialists in medical education, rapid response teams and pre-hospital emergency were selected using the purposeful sampling method. Inclusion criteria were five years or more of service experience in a job position as a member of DMAT, or experience of being a member of this team for more than five years, and high interest and motivation to participate in the research. It should be noted that the participants in Delphi were not present in any of the previous two stages of the study.

Out of 25 selected experts, 22 experts participated in the study. The characteristics of the participants in the Delphi are shown in Appendix 3. To perform the first

round of Delphi, the initial list of roles, duties, and training requirements was sent to the study participants as a 5-scale Likert checklist. Participants were asked to comment on each of the identified items by choosing one of the options: strongly disagree (0 points), disagree (1 point), no comment (2 points), agree (3 points), and strongly agree (4 points). According to the number of participants in the study (22 people), the score of each item (based on a 5-point Likert scale) was considered between 0 and 88. Based on the opinions of experts and participants, Items that obtained more than 80% of the total score (70.4) were included in the findings as the main items. Items that scored between 60 and 79.99% of the total score (52.8 and 70.39) were used as guidelines for the second round of Delphi, and those with less than 59.99% total score (52.79) were eventually excluded. In the second round of the Delphi survey, items with a score of 60 and 79.99% were sent back to the participants after a week to receive their final comments. Items receiving more than 80% of the total scores in the second round were included as the main items.

A week later, in the third round, the results were sent to the participants to finalize the items of the previous two rounds. After a week, the answers were collected. Data analysis at this stage was done using Excel software. We only mentioned the report of the final results due to the prevention of repetition and multiplicity in the tables.

Results

Results of Step 1(roles and duties of DMATs): Based on the purpose of the study in the first stage, 2428 articles were found in the mentioned databases in the initial search; all of them were entered into the EndNote software. After the duplicate articles were deleted, 1439 articles remained. Finally, after studying the titles and abstracts of the articles, 15 articles that specifically addressed the roles and duties of DMATs were included in the study as final texts. Considering that a narrative review was used in this study, only studies directly about the roles and tasks of DMATs were selected. The bibliographic information of the selected studies is summarized in [Table 1](#). This table includes the author's name, the year of the study, the article type, the research place, and the Summary of roles and duties. DMATs are generally divided into three main subgroups: health team, treatment team, and logistics team (support). According to the study's findings, the health team has nine sub-units and one senior health person, the support team has three

sub-units and one senior support person, and finally, the treatment team has three sub-units, one senior treatment expert, and 1 DMAT boss. Studying the articles in [Table 1](#), the roles and duties of DMATs were identified. These roles and duties were divided into two general and specific categories. Specific roles are shown in column 3, [Table 2](#), and general roles in column 3, [Table 3](#).

In these tables, it is demonstrated that rules and duties obtained from which study. As can be seen, six general roles have been identified for all DMAT members. In the health team, there were two main roles for the senior manager, five roles for the Expansion unit, seven roles for the disease control unit, four roles for the environmental health unit, seven roles for the family health unit, four roles for the health education unit, ten roles for the nutrition unit, eight roles for the mental health units, five roles for the laboratory unit and four roles for the drug unit. Moreover, in the logistics team, there were three roles for the senior manager: two roles for the statistics and communication unit, three roles for the service unit, and two roles for the logistics unit. In the treatment team, there were nine roles for the DAMT head, three roles for the senior treatment officer, six tasks for the triage unit, eight roles for the AMP unit, and five roles for the transfer unit.

Step 2 and 3(training requirements of DMATs): In the second step, 105 specific and 16 general training requirements were found based on expert opinions in FGD. The findings of this step were entered into Delphi for finalization. Due to the large number of tables, the findings of this step were not presented in a separate table, and only the final training requirements obtained from Delphi were reported.

Finally, in the third step of the study, the training requirements of DMAT members were determined. Specific training requirements are in column 4, [Table 2](#), and general training requirements are in column 4, [Table 3](#). The agreement percentage of the items can be seen in the last column of [Tables 2 and 3](#). Seven general training requirements have been identified for all DMAT members. Five specific training requirements were identified for the health unit chief.

In addition, there was one specific training requirement for the expansion unit, 8 for the disease control unit, 5 for the environmental health unit, 2 for the family health unit, 3 for the health education unit, 5 for the nutrition unit, 9 for the mental health unit, 3 for the laboratory unit and finally 2 for the drug unit. Moreover, in the logistic team, there were four specific

training requirements for the senior: 5 for the statistics and communication unit, 1 for the service unit, and two skills for the support unit. Finally, the treatment team had five specific training requirements for the DAMT commander: 7 for senior treatment members, 4 for the triage unit, 9 for the AMP unit, and 5 for the transfer unit.

Discussion

Roles and duties of DMATs: In the first step of the study, the roles and duties of the DMATs were identified and were shown in health, treatment and support teams. Each team has units that perform their specific roles and duties to provide medical services for affected people in a disaster. Other studies have been conducted on DMATs that emphasize the necessity of creating a clear structure as well as the roles and duties of members. Foo et al. emphasize in their study that the main teams and sub-teams of DMAT should have distinct and separate roles. In this study, they have focused more on the roles of the treatment team, especially the AMP and triage units. Roles such as immediately creating a triage location, performing triage based on START and JUMP START methods, and monitoring the timely treatment of the injured have received more attention (21). Although the primary duty of the treatment team is to care for the injured, they cannot manage every aspect of emergencies alone. Health and logistics team members must be fully informed of their responsibilities to manage emergencies effectively. In their study, Suner et al. examined the historical process, the organizational structure, and the roles and responsibilities of DMATs. They stated that assigning roles to specialized health, treatment, and logistic teams was very important and could be done specifically for educational programs. This study defines roles for each team and sub-teams that guide emergency operations. Roles such as psychological support for the injured and DMAT members for the health team, transport of the injured and DMAT members for the logistics team, and finally, triage of the injured for the treatment team have received more attention than others (22). In their study, Lyama et al. stated that each team had specific tasks that differed from the functions and roles of the other teams. They pointed out that the ultimate goal of DMATs was to save the lives of accident victims; however, this was done by different specialized teams. In addition, within each team, small groups should have more specialized tasks for specific situations to help the victims more effectively. The treatment team has received more

attention in this study, and duties, including triage, patient admission and initial treatment, and patient transfer, have received more focus than other roles (23). These studies show that separating roles and duties into specialized groups is critical in DMAT. Educational planning will be ineffective without recognizing the roles and duties as well as the training requirements of the members. In this case, the members of the specialized teams recognize their respective roles and, as a result, are trained in the same field; the presentation of voluminous and sometimes irrelevant information is thus avoided.

Training requirements of DMATs

General training requirement: As the main objective of the study, the training requirements for each DMAT unit were identified. It was shown in these stages that some tasks, such as the skill of putting up a tent, had a general aspect, and all members of the DMAT should know how to do it because there is an urgent need to put up a tent in an emergency to do the work. Planning, cooperation, coordination, and communication were other general skills that were emphasized in this study. Such skills can be taught in groups, and training programs can be arranged so that more people can be trained simultaneously. Akbari et al. state in their study that DMATs need training programs to improve their performance. According to them, the members of DMATs in Iran should learn some aspects of management in general because these teams include people with different expertise. In this study, planning and communication skills have received more attention than general skills (24). Lee et al. pointed out in their research that in addition to the specific skills of the health, treatment, and support teams, there were skills common to all members of the rapid response teams, and all members of the teams should receive training in these skills. These skills included putting up and collecting tents, using communication tools, documenting skills, cooperating with other members and teams, and coordinating. This study stated that general skills, such as those mentioned above, could save time because people were trained in critical situations and could take immediate action to perform any activity, such as putting up a tent (25). This study mainly considers the general training requirements of DMATs, and as seen, they are consistent with our results. Sklar et al. also emphasize in their study that recognizing the types of disasters and their specific needs and planning are skills that all DMAT members should be trained on. According to them, the uniqueness of disasters can lead to mistakes in rescuers' decision-making. Therefore,

DMAT members must learn these skills and be able to plan correctly in any situation (11).

Health team training requirement: The most crucial training requirement identified in this study for the health team is to know the types of disasters and their health needs. Each type of disaster is unique, and its health needs are entirely different. In general, the activities of this team ensure the continuation of the functions of DMAT. Since the health team has many sub-teams and each has different roles, we mention only a few of this team's most essential training requirements here. In the present study, the analysis of health statistics, quick assessment of health needs, immunization of the population affected by disasters, and finally, mental health were the skills that were emphasized more than others by the experts. Arizman et al. emphasized the most prominent skills required for health teams in their study. They stated that analyzing and interpreting information to calculate health indicators was the main skill these teams must be trained in this field. In addition, recognizing different types of accidents and their health needs, as well as taking action to meet the health requirements of the affected area based on the type of the accident and the amount of damage, are other vital issues in this regard. According to them, the activities of the health team ensure the continuation of rescue operations in the affected areas, which can lead to the overall success of the DMATs (10). The findings of this study are closely aligned with the results of the present study. In their study on the simulation of the accident and the deployment of rapid response teams at the scene, Barelli et al. pointed out that the health team should be able to assess the area's health needs quickly, assess the amount of damage to the health infrastructure, analyze and interpret information, and take immediate and appropriate measures to meet essential needs (26). This study explores the health team and their roles in providing services. Additionally, some of the team's training requirements for performing the duties have been presented, which are compatible with the current study's findings.

Logistic team training requirement: The present study determined the training requirements of logistics teams, which play a vital role in the continuation of DMAT activities. The nature of logistics team training is different from that of treatment and health teams because the team members haven't a direct relationship with the injured. In the current study, alternative communication methods and providing alternative resources (fuel, electricity, etc.) were recognized as the

most important training requirements of the logistics team, which were emphasized more than other skills. Masudome et al. state that although logistics teams do not directly relate to the injured in accidents, their performance can strongly affect the function of DMAT. For example, the lack of fuel or suitable vehicles to move the injured disrupts other teams' activities. According to them, this team's most important training requirements are providing different communication platforms, fuel, amenities, alternative transportation methods in disasters, etc. (27). The findings of this study also confirm the results of the present study. In their study on a logistic team of DMAT, Aitken et al. noted that recognizing the types of accidents and understanding their logistic needs was one of the most crucial skills needed for support team members. Thus, they know the needs of every kind of accident and can plan to respond to it. In addition, members of this team should be familiar with various methods of transporting and carrying logistic supplies such as water, food, and fuel, and if necessary, try to take them depending on the type of the accident and the amount of damage to the infrastructures (28). The study's findings are consistent with the training requirements determined for the logistics team in the present study.

Treatment team training requirement: The main mission of the treatment team in DMAT is to help and rescue injured people immediately and transport them to medical centers. The current study highlighted training requirements such as triage, first-and second-aid, save and rescue, and principles of transferring the injured. In addition, suitable physical characteristics for relief activities were another training requirement addressed in this study. Experts advise that the treatment team members have solid physical constitutions since, in some circumstances, it may be necessary to transport the injured person right away. In a study on the skills of the treatment team, Hanlon et al. concluded that there were three vital skills for the treatment teams at the time of the accident. The first skill is to identify the types of accidents and the medical needs of each. Thus, unforeseen cases are less likely to be faced, and people are prepared to treat different types of injured people and other victims. The second skill is triage and information collection. Many resources are well-spent with triage, and people who need help faster and sooner are deprived of services. First and second aid skills are the last skills that team members need to learn and improve because their main mission is to help and rescue injured people immediately. In addition to

having scientific and practical qualifications, treatment team members must be periodically and continuously trained and put into operational conditions (29). This study considers the treatment team and their role in disaster response. In addition, several items have been suggested as training requirements for this team. The results of this study are closely aligned with the present study's findings. In their study on the physical characteristics of members of rapid response teams, Romney et al. noted that members of the treatment team should be physically fit and be able to treat people appropriately in various situations. In addition, they should be familiar with the different methods of transporting and carrying the patients and do the necessary physical exercises. In their opinion, physical fitness is more important for treatment team members than for other team members because they often provide direct treatment and first aid help, and they should carry the patients or change their positions in certain circumstances. Therefore, they must be able to rely on their strength to take immediate action to help the victims (30).

Since the main focus of DMATs is to provide medical care to the injured, the DMAT commander and the treatment senior are included in the treatment team. As seen in Table 2, some of the team senior skills for all three teams overlap. We discuss some of them here. For senior teams, safety principles, management skills, and communication and alternative communication skills were recognized as training requirements in the current study. In their study, Choa et al. introduced more practical skills for team commanders and seniors; concerning their scientific credentials, they pointed out that familiarity with skills such as the ability to use electronic communication devices, the ability to interpret information, and the ability to present reports was of great importance. According to them, using electronic communication devices during accidents or disasters is crucial because various communication methods may be disrupted due to the accident's severity, and the rapid response team may need help communicating. Thus, commanders must be aware of alternative approaches and know how to use them (31). This study mainly focused on training commanders and senior teams, and its results are visible in the present study.

As observed, the findings of other studies confirmed the results of this study in identifying the skills and training requirements of DMAT teams. A noteworthy point in this study is the comprehensiveness of

recognizing skills and training requirements that have attempted to cover all components of DMAT teams and provide a better understanding of the interactions between team members. Most studies in this field have only sporadically or specifically addressed a particular team's skills and training needs and need more comprehensiveness to design a training program. It was shown in the present study that members of DMAT teams, in addition to field knowledge, which is the primary qualification for membership, must have skills that can only be displayed in emergencies; thus, paying attention to them is very important. One of the most critical points in this study is that its results can be used to formulate educational programs for DMATs. Revising or developing a new curriculum based on scientific findings can improve the performance of these teams in emergencies.

Limitations: There may be some limitations in this study. The main limitation is the need for previous research studies in Iran. Several studies have been conducted on DMATs in Iran, but they have not paid attention to their training requirements and duties. In this way, it is impossible to compare the study results with the findings of others in this country. It has been attempted to address this limitation by discussing the findings of research that are most similar to the current study in terms of objectives, study methodology, and DMAT structure. The inability to generalize the study findings to other countries is another limitation of this study. As mentioned in the method, this study is designed based on the structure of DAMT in Iran. In this way, the roles and duties, as well as training requirements of the members, are consistent with this structure. DMATs do not have the same structure in all countries, and each uses a different structure depending on its conditions. In this way, the results of this study may not be applicable in some countries. However, the methodology of this study can be used in any country, and the training requirements of DMATs can be determined accordingly. Despite the mentioned limitations, the study results can be used as a preliminary step in designing educational programs. In this way, it is suggested that future studies on educational programs be developed based on these findings.

Conclusion

DMATs are among the first teams to be dispatched to the disaster area to provide health care services to the disaster victims. DMATs are an integral part of disaster response operations, and their actions can play a vital role in the success of disaster response. On the other

hand, DMAT members usually work individually in healthcare jobs and join each other as a team, depending on emergency conditions. Therefore, they need continuous training to perform their duties. The findings of this study showed that different skills are necessary for each role of DMATs. In addition, each skill requires special training. This study also notes the separation of training requirements for other teams. This allows for the consideration of training for specific target groups, saving time and money. Finally, the findings of this study can be a starting point for designing training programs for these teams.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The ethics committee of Kerman University of Medical Sciences (code number: IR.KMU.REC.1401.213) approved the study protocol. All participants were informed about the purpose and method of the research and informed consent was obtained from them. In addition, participants were assured of confidentiality and anonymity. In addition, participants were told that they could withdraw at any stage of the study for any reason. All study procedures were performed according to the guidelines of the Declaration of Helsinki.

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Table 1. Characteristics of selected studies

Author name	Year	Article type	Location	Summary of roles and duties
Al-Shehri	2022 (9)	Original	KSA	The roles of communication and information about the affected community have been considered.
Bodas	2022 (7)	Original	Germany and Turkey	The structure, some roles and tasks of the DMATs are described
Foo	2021 (21)	Original	Taiwan	The structure and composition of DMATs in Taiwan as well as the roles and tasks of each team are described.
Waganew	2021 (5)	Original	Ethiopia	The roles and duties of the treatment team during disasters have been defined.
Lyama	2021 (23)	Original	Japan	The treatment team has received more attention in this study, and duties including triage, patient admission and initial treatment, and patient transfer have received more focus than other roles.
Akbari	2020 (32)	Original	Iran	The organizational structure and composition of DMATs in Iran as well as their tasks have been studied and suggestions have been made to improve the preparation of the teams.
Kondo	2019 (33)	Original	Japan	DMATs are divided into three teams: hygiene, Treatment and Logistics and their composition and functions in Japan have been examined and suggestions have been made to improve their performance
Bartolucci	2019 (34)	Original	Netherlands	The role of data manager and epidemiologist in the health team has been considered
Arziman	2015 (10)	Original	Turkey	Outlines the roles and responsibilities of health, treatment and logistics teams in general and emphasizes that a number of these roles are shared between different teams
Suner	2015 (22)	Original	Turkey	Roles such as psychological support for the injured and DMAT members for the health team, transport of the injured and DMAT members for the logistics team, and finally triage of the injured for the treatment team have received more attention than others
Djalali	2014 (35)	Original	Italy	Some of the roles and tasks of the DMAT trio teams are mentioned. The importance of cooperation as well as the integration of teams and groups in some emergencies to increase productivity and efficient use of resources has also been expressed.
Abbasi	2013 (36)	Original	Iran	The roles and responsibilities of the DMAT commander and the treatment team in the accidents are stated.
Aitken	2012 (28)	Original	Australia	The structure, roles and tasks of the DMATs are described. Also, the observance of standards and protocols by members of operational teams and commanders has been reviewed.
Sklar	2007 (11)	Original	USA	The general roles of DMATs in responding to disasters are described. This study emphasizes that it is impossible to provide relief to the injured and affected people without dedicated DMAT teams. In addition, the roles and tasks of treatment and logistic teams in disasters are described.
Franco	2007 (37)	Original	USA	The roles and responsibilities of the healthcare team in disasters are mentioned and it is emphasized that the duties of these two teams are in line with each other and they should have additional cooperation and coordination with each other.

Table 2. Specific roles and duties and specific training requirements

Main team	Subunits	Roles and duties	Skills and Training requirements	Agreement percentage–Delphi round
Health Team	Health Senior	Supervising, directing, coordinating and commanding the health units of the subdivision Collect statistics and reports of sub-units and present them to the team commander and the university's rapid reaction team statistics unit (21, 38, 39)	Management skills include command, coordination and control How to work with communication and alternative communications tools Designing and implementing group exercises Knowledge of safety principles (personal-environmental) Interpretation of statistics and information and reporting	89- R1 80.3- R2 91- R1 82.7- R1 83.9- R2
	Expansion unit	Holding various meetings with experts Reporting existing health bottlenecks and deficiencies and suggest appropriate solutions Utilizing statistical data collected for planning purposes Coordination and cooperation with current health programs in the region Analysis of statistics and information to calculate health indicators (10, 33, 37)	Analysis and interpretation of statistics and information in order to calculate health indicators	92- R1
	Disease control unit	Rapid assessment of infectious diseases Assessment the extent of injury and disease Estimating the extent of damage to health infrastructure Prevention and control of infectious and non-communicable diseases vaccination Investigation of disease outbreaks Collecting data such as basic health information, population structure, mortality, the main disease of the region and ... (21, 33, 35, 37)	Recognizing of common diseases in different types of disasters How to collect, analyze and interpret data such as basic health information, population structure, mortality, the main disease of the region and ... How to quickly assess the area to identify the disease Assessment the extent of injury and disease How to estimate the amount of infrastructure damage How to prevent and control infectious and non-communicable diseases Immunization methods Investigation of disease outbreaks	96.6- R1 91.2- R1 82.1- R2 91.2- R1 80.3- R2 96- R1 100- R1 98- R1
	Environmental Health Unit	Rapid environmental health assessment Monitoring water hygiene and wastewater disposal Health monitoring of the shelter and rapid response team Hygiene monitoring of food, spraying and disinfection of contaminated environments (10, 33, 38)	How to collect, analyze and interpret environmental data rapid assessment of environmental health status How to monitor water hygiene and wastewater disposal How to monitor the health of the shelter and the rapid response team Recognizing the types of disinfectants and perform disinfection in different conditions	93- R1 96.2- R1 90- R1 82.3- R2 80.9- R2
	Family Health Unit	Providing maternal care Providing neonatal care Providing child care	Recognizing the needs of different age groups in different types of disasters How to provide care to target groups	98.1- R1 96- R1

		<p>Providing teen care Providing middle-aged care Providing healthy reproductive care Providing care for the elderly (10, 35, 37, 39)</p>		
	Health Education Unit	<p>Analyze the health status of the area Evaluating existing communication tools Determining the educational priorities Separation of the target population from the general public to increase awareness and maintain health (21, 33, 37)</p>	<p>How to determine the educational priorities of the region Different training methods in emergency situations Analysis and interpretation of regional health information</p>	<p>93.6- R1 83.1- R1 88- R2</p>
Health Team	Nutrition unit	<p>Assessing the nutritional status of the affected population Determination of nutritional deficiencies and water and foodborne diseases in vulnerable groups Review equipment and provide a list of equipment required for nutrition to the Chief of Health Complete the nutritional assessment form of children under 5 years old in disasters Complete the rapid assessment of the nutritional status of the household in disasters Monitoring the food security of affected households Food basket monitoring in terms of safety and health Monitoring the nutritional needs of infants Teaching proper nutrition in crisis to employees and the affected community Referrals to medical centers for people with malnutrition (10, 33, 38)</p>	<p>Recognizing nutritional needs in different types of disasters How to perform rapid nutritional assessment in various disasters Equipment assessment and provide a list of equipment required for nutrition to the Chief of Health Identify target populations and monitor their nutritional status Skills to provide training to the target population</p>	<p>89.7- R1 93.2 – R1 83.5 – R2 96.3- R1 80.3 -R2</p>
	Mental health unit	<p>Gather the necessary information about the dead, injured, dispatched and orphaned children Record essential information on family health cards Photographing all corpses Proper performance of funeral and mourning ceremonies based on local customs and traditions Perform special interventions for specific groups, children, the affected and PTSD Formation of an executive committee to reduce the psychological effects of disasters Psychological support for DMAT personnel Establish a proper connection between the survivors (33, 37)</p>	<p>Recognize mental needs in different types of disasters Skills in collect and record essential mental health information Photography skills Gathering the necessary information about the dead, injured, dispatched and orphaned children Proper performance of funeral and mourning ceremonies based on local customs and traditions Planning for group interventions in psychosocial support Perform special interventions for specific groups, children, the elderly and people with PTSD Formation of an executive committee to reduce the psychological effects of disasters Understanding the psychological needs of DMAT members</p>	<p>91.6- R1 96.5-R1 80.9- R2 83.7- R2 89.7-R1 83.9 – R1 93.8- R1 88.3- R2 85.1- R2</p>

	Laboratory unit	Investigation of common diseases in the area for the transfer of related kits (usually before moving) Announce samples of feasible tests and referrals Collaborate with the Environmental Health Unit for water health assessment Perform tests required for the care of infectious and non-communicable diseases communication with other teams' labs regarding experiments were can be performed by them (10, 33, 37, 38)	Recognizing common diseases in different types of disasters Investigation of common diseases in the area for the transfer of related kits (usually before moving) Perform tests required for the care of infectious and non-communicable diseases	89.1- R1 81.3 –R1 81.2- R2
	Drug unit	Designing the layout of existing drugs to increase productivity Reassess, check for outbreaks or damage, and anticipate medications needed Preparation of drug checklists Preparation a checklist of medications to report and replace (10, 37)	Recognizing common diseases and drugs needs in different types of disasters Designing the arrangement of available drugs for efficiency in time and distribution of drugs	92.3- R1 83.2- R1
Logistic team	Logistic Senior	Supervising, directing, coordination and command Logistic units Providing the vehicles needed to transport personnel and equipment to the accident area Continuous communication with the DMAT commander and reporting to him (10, 32, 36, 38)	Recognizing logistical needs in different types of disasters Management skills include command, coordination and control Designing and implementing group exercises Knowledge of safety principles (personal-environmental)	93.1- R1 95.7- R1 83.9- R2 91.3 – R2
	Statistics and Communications unit	Establishing communication network via wireless, mobile phone, satellite phone and walkie-talkie between the transfer, triage, treatment, health, command, mobile units and regional headquarters teams Collecting information and transferring them to the relevant units (33, 39)	Recognizing communication needs in different types of disasters Recognizing and applying alternative communication methods Maintenance of communication devices Skills how to create a communication network in different situations Different methods of collecting information	96.8- R1 97.6- R1 86.1- R1 89.1- R2 86.9- R1
	Service unit	Setting up a place for staff to rest and eat Transportation (Corpses, affected people and personnel) Providing staff supplies and amenities (10, 11, 35)	Recognizing communication needs in different types of disasters	96.8- R1
	Logistic unit	Procurement of equipment and manpower Providing optimal conditions to provide services to the victims such as electricity supply, water supply, fuel supply (21, 33, 38)	Recognizing communication needs in different types of disasters Identifying alternative resources in the affected area	91.4- R1 89.6- R1
Treatment team	DMAT Commander	Supervision, coordination and command Continuous communication with the team headquarters commander at the university Continuous communication with team senior Determining the appropriate location for the team Command to set up a command and logistic tent at the beginning of the deployment	Management skills include command, coordination and control Designing and implementing group exercises Knowledge of safety principles (personal-environmental) Interpretation and analysis of information General concepts of public health	96.2- R1 89.7-R2 91.2-R1 80.2- R2 96.1- R1

		<p>Proper distribution of personnel among the regions Monitoring and evaluating the performance of operational units Issuance of transit permit Continuous communication with the ICP General Area Command (21, 32, 36, 39)</p>		
	Treatment Senior	<p>Receive statistics and reports from the triage, treatment and transfer unit Providing statistics to the statistics unit and team command Supervise, direct and coordinate sub-units (32, 33, 35, 36)</p>	<p>Management skills include command, coordination and control Designing and implementing group exercises Knowledge of safety principles (personal-environmental) General concepts of public health Interpretation and analysis of information Knowledge of different triage methods First and second aid</p>	<p>95.1- R1 83.1- R1 80.1- R2 82.1- R1 81.5- R2 100 – R1 100- R1</p>
	Triage unit	<p>Deployment at the designated location and setting up a triage tent Perform triage based on START and JUMP START methods Triage location zoning based on triage colors Complete the triage card Storing the equipment of the injured and installing the triage code on the equipment Announce statistics and needs to the head of the triage unit (33, 38, 39)</p>	<p>Understanding the different methods of triage and how to zone and complete the triage card How to collect information First aid How to deal with the injured and psychological support</p>	<p>100- R1 87.1- R2 100 – R1 90.9- R1</p>
Treatment team	AMP unit	<p>Patient admission Re-triage Performing basic therapeutic measures Displacement of patients Reporting deficiencies and needs to the AMP manager Monitoring the treatment process of the injured Check equipment and announce needs Coordinating the referral of patients to field hospitals or other medical centers (32, 33, 35, 38)</p>	<p>First and second aid Recognition of drugs Familiarity with different triage methods and knowledge of different codes and colors How to work with rescue equipment, communications and their maintenance Physical fitness and physical training How to deal with the injured and psychological support Knowledge of safety principles (personal-environmental) Methods of transporting the injured and training them General concepts of public health</p>	<p>100 – R1 93.2- R1 100 – R1 87- R2 91.3- R1 89.3-R1 85.4- R2 89.4 – R1 98.1 – R1</p>
	Transmission unit	<p>Deployment of ambulances Complete the patient dispatch form Record reports and statistics to the head of the transfer unit Familiarity with the location of AMPs and field hospitals Continuous monitoring and coordination of all ambulance dispatches (10, 33)</p>	<p>Understand the types of transfer methods and alternative methods Physical fitness and physical training First aid Knowledge of safety principles (personal-environmental) How to deal with the injured and psychological support</p>	<p>96.8 – R1 96.5- R1 82- R2 80.8-R2 81.6 – R2</p>

Table 3. General roles and duties and general skills and training requirements

Main team	Subunits	Roles and duties	Skills and training requirements	Agreement percentage – Delphi round
All teams	All Subunits	Planning how to perform actions Setting up equipment tent Coordination and cooperation Documentation actions Reporting to the Chief of teams Communication with other subunits and other teams (11, 21, 32, 35-37, 39)	Recognizing the types of accidents and disasters Skills for setting up tents and equipment Planning skill based on information obtained and condition Coordination and cooperation with other sub-teams and other responders Documenting the actions taken and reporting to the team leaders Communication skills included (communication within the team, communication with the target group) Understanding how to use personal communication equipment	96.2 –R1 98.1- R1 81.3- R2 86.7- R2 93.2 – R1 87.6- R1 95.2- R1

Appendix 1. Search Strategy

The search strategy in this study was as follows: (((((((("disaster medical assistance team"[Title/Abstract]) OR (DMAT[Title/Abstract])) OR ("emergency medical teams"[Title/Abstract])) OR (EMTs[Title/Abstract])) AND (tasks[Title/Abstract])) OR (roles[Title/Abstract])) OR (duties[Title/Abstract])) OR (functions[Title/Abstract])) OR (missions[Title/Abstract])) OR (responsibilities [Title/Abstract]).

Appendix 2. Characteristics of the participants in the FGD

Participant code	Characteristics of the participants in the FGD								Field of Study
	Sex		Education level			Work experience			
	Male	Female	Bachelor	MSc	MD or PhD	5-10	10-15	More than 15	
P1	✓			✓			✓		Medical education
P2		✓			✓	✓			Medical education
P3		✓			✓	✓			Medical education
P4	✓				✓	✓			Health in emergencies and disasters
P5	✓				✓		✓		Health in emergencies and disasters
P6		✓			✓			✓	Health in emergencies and disasters
P7	✓				✓	✓			Health in emergencies and disasters
P8	✓				✓	✓			Health in emergencies and disasters
P9	✓				✓		✓		Health care management
P10		✓			✓			✓	Health care management
P11	✓			✓				✓	Public administration
P12	✓			✓				✓	Human Resource Management
P13	✓				✓			✓	Medical Doctor
P14		✓		✓			✓		Nurse

Appendix 3. Characteristics of the participants in the Delphi

Participant code	Characteristics of the participants in the Delphi								Field of Study
	Sex		Education level			Work experience			
	Male	Female	Bachelor	MSc	MD or PhD	5-10	10-15	More than 15	
P1	✓				✓	✓			Emergency medicine
P2	✓				✓		✓		Emergency medicine
P3	✓				✓		✓		Emergency medicine
P4	✓				✓		✓		General surgery
P5	✓				✓			✓	General surgery
P6		✓			✓	✓			General physician
P7	✓				✓		✓		General physician
P8	✓		✓			✓			Nurse
P9		✓	✓			✓			Nurse
P10		✓	✓			✓			Nurse
P11	✓			✓			✓		Nurse
P12	✓		✓				✓		Nurse
P13	✓		✓			✓			Pre-hospital emergency technician
P14	✓		✓				✓		Pre-hospital emergency technician
P15	✓		✓				✓		Pre-hospital emergency technician
P16	✓		✓			✓			Pre-hospital emergency technician
P17		✓			✓	✓			Medical education
P18		✓			✓		✓		Medical education
P19		✓			✓		✓		Medical education
P20	✓				✓			✓	Health in emergency and disasters
P21	✓				✓	✓			Health in emergency and disasters
P22		✓			✓	✓			Health in emergency and disasters

Survey of the Medical Sciences Students' Attitude Towards Research

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Abstract

Background: Research is essential for societal development and medical sciences. Medical schools should train researchers and promote a research culture.

Objectives: This study assessed the attitude of medical students at Tabriz University of Medical Sciences (TUOMS) towards research.

Methods: This cross-sectional, comparative study was conducted at Tabriz University of Medical Sciences in 2024. A sample of 682 students was randomly selected, with 609 responding to the questionnaire (response rate: approximately 89.3%). The questionnaire, adapted from Sobczuk et al., explored students' research attitudes. Data analysis involved one-sample T-tests and MANOVA using SPSS 26."

Results: A survey conducted among medical students revealed a generally positive attitude toward research. The item 'We're living healthier and safer with science' received the highest ranking (Mean = 3.93±0.955). However, the study also highlighted challenges in research engagement. The most significant barriers identified were a lack of information on scientific work opportunities (Mean = 3.77±1.34) and insufficient funding/grants for research (Mean = 3.74±1.33). Gender and academic semester did not significantly influence attitudes or perceived obstacles, but the field of study played a significant role. Paramedicine students exhibited lower attitudes toward research than Medicine, Dental, and Pharmacology. Additionally, Paramedicine reported more perceived obstacles, supported by statistically significant p-values ($p < 0.001$). Despite the overall positive view, this underscores the need for educational and financial support to encourage active student participation in research."

Conclusion: The findings suggest that the students are interested in research but need more support and guidance. The university should offer courses on research methods, increase awareness of research importance and benefits, provide facilities and resources, and enhance attention from officials and professors.

Keywords: Attitude; Medical Student; Research; Iran

Background

Research is crucial for advancing society and science, especially in medical sciences (1). It aims to generate and apply knowledge that can classify, describe, explain, evaluate, relate, compare, predict, and manipulate various situations, phenomena, and observations (2). Medical universities are responsible for educating future researchers and fostering a research culture in students (3). This allows them to acquire and use knowledge, skills, and attitudes in different areas of medicine (4). However, many students face difficulties and challenges in conducting and completing research projects, such as lack of time, resources, guidance, motivation, and

interest (5). Therefore, examining and improving the students' research attitude is vital, as it can influence their research performance, quality, and outcomes (6). The research attitude in health sciences stems from the researchers' curiosity and interest in a topic or their motivation to solve a problem in a community (7). A positive research attitude can enhance the students' research skills (8), such as critical thinking (9), problem-solving (10), creativity (11), and communication (12), and boost their research quality (13), interest and motivation (14). A negative research attitude can hinder the students' research potential and performance

discouraging them from engaging in research activities and opportunities (15).

Students of medical sciences need a positive research attitude, as they will shape the future of the health sector with their discoveries and innovations (16). To achieve this, they need adequate and appropriate research methods teaching that cover both theory and practice of conducting high-quality and ethical studies in various fields of medicine (17). They also need guidance, support, and motivation from their mentors, peers, and institutions, who can offer them constructive feedback, recognition, and access to relevant resources and opportunities (17). Moreover, they must be part of a collaborative and conducive research culture and environment that fosters curiosity, creativity, and critical thinking and values diversity, integrity, and excellence (18). By creating such conditions, students of medical sciences can improve and utilize their research skills and knowledge, and positively impact the medical field and society (19).

Research on students' attitudes towards research (20-24) has highlighted educational gaps and limited participation as significant barriers, with no clear link to gender, knowledge level, or employment status. Asadollahi et al. (25) found that factors like research self-efficacy and academic experiences explain 28% of attitude variance without demographic or academic differences. Babamohammadi et al. (26) observed a positive research attitude among Semnan medical students, with active engagement in research activities but less in publishing or project execution. Razavinia et al. (27) reported that most Qom medical students had a moderate attitude toward research, unaffected by gender or research experience. Abun et al. (28) linked cognitive and emotional attitudes to research intentions. Camacho Torres et al. (29) noted a negative research attitude among higher education students. Sobczuk et al. (30) identified that a third of Warsaw medical students aim for research careers, facing challenges like time and resource constraints. El Achi et al. (31) found a positive attitude but low engagement in research among students at the American University of Beirut, suggesting mentorship improvements. Estrada et al. (32) and Rojas Solis (33) also found a generally negative or neutral research attitude with no gender-based differences. Moradabadi et al. (34) identified a lack of research skills and resources as significant barriers. Marmarpour et al. (35) reported positive attitudes but average knowledge, highlighting obstacles such as lack of support and distrust in domestic research outcomes. Izadi et al. (36) noted a correlation

between educational level and research awareness and attitudes, with higher levels correlating with better attitudes and awareness. Cruz et al. (37) and Olivera (38) observed average attitudes toward research, with psychology students showing more positivity than management students. Kyaw et al. (39) identified the main barriers of time, knowledge, budget, facilities, and rewards. Overall, the research indicates that while students generally have positive or average attitudes toward research, they face significant challenges, including a lack of knowledge, resources, and support. These studies collectively underscore the need for better educational support and resources to foster a positive research attitude.

Tabriz University of Medical Sciences (TUMS) is one of Iran's oldest and largest medical universities, with more than 8,000 students in various fields of medicine, dentistry, pharmacy, nursing, midwifery, health, and paramedical sciences (40). TUMS fosters a strong research culture and infrastructure and provides various opportunities and incentives for students to engage in research activities. However, no extensive study has assessed the attitude of TUMS students towards research, and comprehensive and updated data on this issue is lacking.

Objectives

This study aims to fill this gap by exploring the factors that influence the students' attitude towards research and providing valuable insights for improving the quality and quantity of their research performance and development.

Methods

Research Design: This study adopted a cross-sectional descriptive survey to measure the attitude of medical students of TUOMS towards research.

Sampling: "From the total enrollment of 8,602 students during the academic year 2022-2023, we randomly selected 682 participants using Krejcie & Morgan's table (41) and employed a stratified sampling method. These participants provided information on their age, field of study, semester, and gender. Table 1 presents a summary of their demographics:

The mean age is 18.47 years, with a standard deviation of 2.591.

Data Collection: "The Sobczuk et al. questionnaire, customized for the Iranian educational system and culture, underwent a rigorous adaptation process.

Table 1. Demographic characteristics of the sample

Variable		Frequency	Percent
Gender	Male	269	39.44
	Female	413	60.56
Semester	4	149	21.84
	6	153	22.43
	8	165	24.19
	10	111	16.27
	12	63	9.23
	14	27	3.95
	16	9	1.31
	18	5	0.73
Field of Study	Medicine	180	26.39
	Dental	60	8.79
	Pharmacology	150	21.99
	Paramedicine	292	42.81

This involved translation-back-translation to validate its content. Initially, the questionnaire was translated from English to Farsi by a bilingual expert familiar with both languages and the cultural context. A separate bilingual expert, uninvolved in the initial translation, back-translated the Farsi version to English. Discrepancies were checked against the original questionnaire to ensure accuracy. To further validate the questionnaire, a panel of experts in the field assessed its content validity. Additionally, the questionnaire's reliability, assessed using Cronbach's alpha coefficient (0.71), indicated sufficient internal consistency, with the attitude towards the research variable (0.73) and the Obstacles to conducting the research variable (0.7). The 23-item questionnaire used a 5-point Likert scale with scores ranging from 1 (completely disagree) to 5 (completely agree). This allowed for a minimum possible score of 23 and a maximum of 115, quantitatively measuring the students' attitudes and perceived barriers. Demographic data (age, semester, gender, field of study) were collected for comprehensive analysis. The response rate was 89.3%, facilitated through email and social media."

Data Analysis: In the study, SPSS 26 was utilized for data analysis. Descriptive statistics summarized the data, including frequency, percentage, mean, and standard deviation measures. Additionally, inferential statistics were applied to test hypotheses and research questions. Specifically, a one-sample t-test compared students' attitudes toward research with the theoretical mean of 3. The value of 3 is commonly used as a neutral midpoint in Likert scale surveys, where responses typically range from 1 (strongly disagree) to 5 (strongly agree). This midpoint represents a neutral attitude, allowing respondents to express neither agreement nor

disagreement with the statement. Furthermore, a MANOVA (Multivariate Analysis of Variance) examined the impact of gender, academic semester, and field of study on students' attitudes toward research and Obstacles to conducting research by students.

Results

The study assessed the attitudes and barriers to research among 682 students at TUOMS. The sample included 269 male (39.44%) and 413 female (60.56%) students. Among the fields of study, paramedical disciplines had the highest representation (42.81%), followed by medicine (26.39%), pharmacy (21.99%), and dentistry (8.79%). In terms of academic semesters, the largest group of students was in their 8th semester (24.19%), closely followed by those in their 6th semester (22.43%) and 4th semester (21.84%). Students aged 24 years old were most common (19.35%), with 23-year-olds (16.71%) and 22-year-olds (12.31%) following suit. Older students beyond age 27 were less prevalent in the sample.

To determine the attitude of TUOMS students towards research, a one-sample t-test was used to compare the mean score of the students with the theoretical mean of 3, which indicated a neutral attitude.

The results in [Table 2](#) showed that the mean score of the students was significantly higher than the theoretical mean ($P < 0.001$). Means were used to rank the items related to the research attitude component. Results showed a significant difference in the mean of the 10 items about attitude toward research. The item with the highest mean rank was "We're living healthier and safer with science" ($M = 3.93$), and the item with the lowest mean rank was "Research is important because it develops logical thinking and the ability to deduce" ($M = 2.57$).

A one-sample t-test compared the mean ratings of each obstacle with the theoretical mean of 3. The results are in [Table 3](#).

The students considered most of the obstacles (9 out of 13) as important barriers to research, as their mean ratings were higher than 3 ($p < 0.05$).

The results showed that the mean score of the students was significantly higher than the theoretical mean ($p < 0.001$). Means were used to rank the items related to the Obstacles to conducting the research component. The results are also shown in [Table 3](#). There was a significant variation in the means of the obstacles, implying that the students had diverse preferences for the obstacles.

Table 2. Attitude to Research Items Ranked by Mean Scores Using One-Sample T-Test

Items	Mean (SD)	T	p-value	Rank
1- Science allows us to better understand the world	3.67(1.115)	15.656	< 0.001*	5
2- Every doctor, dentist, pharmacist should know the basis of scientific research	3.65(1.059)	16.023	< 0.001*	7
3- We're living healthier and safer with science	3.93(0.955)	25.431	< 0.001*	1
4- I trust the results of research presented by the public (TV, press)	3.54(1.104)	12.663	< 0.001*	8
5- I trust the research results presented in the scientific journal	3.83(0.949)	22.926	< 0.001*	2
6- Every student should take part in scientific research during their studies	3.30(1.326)	5.892	< 0.001*	9
7- A medical student should be able to plan and conduct a research project and write a scientific publication	3.66(1.250)	13.759	< 0.001*	6
8- Conducting research is important to be a good specialist (clinician) in a given medical field	3.80(1.259)	16.541	< 0.001*	3
9- The methodology of conducting scientific research should be taught at university.	3.78(1.281)	15.819	< 0.001*	4
10- Research is important because it develops logical thinking and the ability to deduce	2.57(1.390)	-8.019	< 0.001*	10
Attitude towards research	3.57(0.44)	33.461	< 0.001*	

*The mean obtained is significantly greater than the theoretical mean and the difference is significant

According to the students, the most important obstacle was lack of information on scientific work opportunities, followed by lack of funding/grants for

research and lack of experience. The least important obstacle was the discouragement of assistants/teachers/colleagues.

Table 3. Obstacles to Conducting Research Items Ranked by Mean Scores Using One-sample T-Test

Items	Mean(SD)	T	p-value	Rank
11- Lack of time	3.28(1.368)	5.429	< 0.001*	9
12- Lack of funding/grants for research	3.74(1.332)	14.576	< 0.001*	2
13- Lack of knowledge of how to start	3.32(1.517)	5.504	< 0.001*	8
14- Lack of information on scientific work opportunities	3.77(1.346)	14.993	< 0.001*	1
15- Lack/ insufficient financial compensation	3.64(1.301)	12.829	< 0.001*	5
16- No idea/research team	3.63(1.375)	11.978	< 0.001*	6
17- More interest in clinical than scientific work	3.47(1.413)	8.618	< 0.001*	7
18- Lack of experience	3.67(1.389)	12.594	< 0.001*	3
19- Lack of knowledge on the subject	3.65(1.363)	12.416	< 0.001*	4
20- Discouragement of assistants/teachers/colleagues	2.22(1.448)	-14.044	< 0.001*	13
21- Lack of substantive preparation in terms of research during the studies	2.34(1.402)	-12.288	< 0.001*	12
22- Greater emphasis on education than science/research	2.51(1.343)	-9.494	< 0.001*	10
23- Fear of making mistakes	2.44(1.328)	-10.931	< 0.001*	11
Obstacles to conducting research	3.2071(0.554)	9.748	< 0.001*	

*The mean obtained is significantly greater than the theoretical mean and the difference is significant

Table 4 presents the results of a Multivariate Analysis of Variance (MANOVA), which also applied to compare the average attitudes toward research and examine the impact of gender, academic semester, and field of study on students' attitudes toward research. The analysis utilizes Wilks' Lambda to determine the significance of each factor.

Multivariate analysis revealed no significant effect of gender on attitudes toward research or perceived obstacles (p = 0.848). Similarly, the semester did not significantly affect these outcomes (p = 0.731). However,

field of study had a significant multivariate effect (p<0.05).

MANOVA tests in Table 5 indicated that the field of study significantly predicted attitudes toward research (F (3, 630) = 5.847, p = 0.001) and perceived obstacles (F(3, 630) = 25.553, p < 0.05).

These results suggest that while gender and semester do not appear to influence students' attitudes toward research or their perception of obstacles, the field of study significantly predicts these outcomes.

Table 6 summarizes the Least Significant Difference (LSD) post-hoc test results for the dependent variables 'Attitude toward Research' and 'Obstacle' across different fields of study.

For attitudes toward research, significant mean differences were found between Field of Study Paramedicine and all other fields (Medicine, Dental, and Pharmacology), with Field of Study Paramedicine having lower attitudes toward research. No other significant differences were observed between the fields.

Table 4. Multivariate Analysis of Research Attitudes by Gender, Academic Semester, and Field of Study

Effect		Wilks' Lambda	F	p-value
Gender	Male	0.999	0.165	0.848
	Female			
Semester	4	0.984	0.744	0.731
	6			
	8			
	10			
	12			
	14			
	16			
Field of Study	Medicine	0.880	13.808	< 0.001
	Dental			
	Paramedicine			
	Pharmacology			

For perceived obstacles, significant mean differences were found between the Field of Study Medicine and Paramedicine, the Field of Study Dental and Paramedicine, and the Field of Study Pharmacology and Paramedicine. Paramedicine had more obstacles compared to Medicine, Dental, and Pharmacology.

Table 5. Tests of Between-Subjects Effects Research Attitudes by Gender, Academic Semester, and Field of Study

Source	Dependent Variable	F	p-value
Gender	Attitude toward Research	0.182	0.670
	Obstacle	0.103	0.748
Semester	Attitude toward Research	0.799	0.588
	Obstacle	0.794	0.592
Field of Study	Attitude toward Research	5.847	0.001
	Obstacle	25.553	<0.001

Discussion

The present study aimed to explore students' attitudes at Tabriz University of Medical Sciences

(TUOMS) toward research and the barriers they encounter. The findings revealed a positive overall view of research among these students, yet their active participation remained limited. Notably, no significant statistical differences were observed in research attitudes or perceived barriers based on gender or stage of study. However, significant variations emerged in research interest and perceived obstacles across different academic disciplines.

Comparing our results with prior studies, a consistent theme emerges: students generally hold favorable or average attitudes toward research, but practical challenges hinder their active involvement. For instance, Asadollahi et al. (25) and Babamohammadi et al. (26) reported positive research attitudes, emphasizing active engagement in research activities. Similarly, Razavinia et al. (27) found that most Qom medical students exhibited a moderate research attitude unaffected by gender or research experience. Our study aligns with these findings, as gender and stage of study did not significantly impact research attitudes or barriers. In contrast, Camacho Torres et al. (29) and Estrada et al. (32) observed a negative or neutral attitude toward research, diverging from the generally positive outlook in our study. However, the lack of active research participation among TUOMS students mirrors the low engagement reported by El Achi et al. (31) at the American University of Beirut, despite a positive attitude.

The barriers identified in our study resonate with broader literature. Kyaw et al. (39) highlighted time constraints, knowledge gaps, budget limitations, inadequate facilities, and insufficient rewards as primary obstacles-consistent with the challenges faced by TUOMS students. Furthermore, Moradabadi et al. (34) and Memarpour et al. (35) emphasized the lack of research skills and resources and distrust in domestic research outcomes as significant hindrances, corroborating our findings.

Our research underscores the need for enhanced educational support and resources to foster a positive research attitude and promote active participation. Addressing these barriers could lead to more profound student involvement and potentially elevate the quality and quantity of research output.

Table 6. Multiple Comparisons of Attitude toward Research and Obstacles across Different Fields of Study

Dependent Variable	(I) Field of Study	(J) Field of Study	Mean Difference (I-J)	Std. Error	p-value
Attitude toward Research	Medicine	Dental	0.0183	0.06521	0.779
		Pharmacology	-0.0710	0.04836	0.143
		Paramedicine	-0.2250	0.04146	<0.001
	Dental	Pharmacology	-0.0893	0.06682	0.182
		Paramedicine	-0.2433	0.06201	<0.001
	Pharmacology	Paramedicine	-0.1540	0.04395	<0.001
Obstacle	Medicine	Dental	-0.0218	0.07619	0.775
		Pharmacology	-0.1244	0.05651	.028
		Paramedicine	-0.4782	0.04844	<0.001
	Dental	Pharmacology	-0.1026	0.07808	.189
		Paramedicine	-0.4564	0.07245	<0.001
	Pharmacology	Paramedicine	-0.3538	0.05135	<0.001

Conclusion

This study concludes that students at the Tabriz University of Medical Sciences (TUOMS) have a positive attitude toward research and recognize its importance in their education and future professions. However, they face numerous challenges and barriers that hinder their active participation in research. These barriers include a lack of information about scientific opportunities and insufficient funding. The study recommends strategies to improve research education and cultivate a research-oriented culture among students, based on their opinions and needs. It also identifies limitations and suggests directions for further research on this topic. This study contributes to the literature on the attitudes and behaviors of medical students towards research and provides insights for enhancing research capacity and quality in medicine.

This study's limitation include using a questionnaire, which may have caused bias and error. Future research can use other methods, such as interviews, focus groups, observations, and experiments, to better understand students' attitudes. Future research can also compare the attitudes of students from different disciplines, levels, and institutions. The findings have several implications for improving research education and culture among TUOMS students. They are 1) Encouraging and supporting the students' positive attitude by giving them more chances and support to do research; 2) Improving the students' research skills and knowledge by holding workshops, providing resources, assigning mentors, and giving feedback; 3) Overcoming the students' research challenges and barriers by securing funding, improving facilities, allocating time, offering guidance, and creating incentives; and 4) Satisfying the students' research interests and

expectations by customizing the research topics, methods, and outcomes to their needs and preferences, and ensuring the research quality and trustworthiness.

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Conflict of interests: There is no conflict of interest.

Ethical approval: The University of Tabriz's ethical principles and guidelines were followed. The ethics committee approved the study with the code of IR.TABRIZU.REC.1402.123, and the participants consented before the data collection. The participants were informed about the study's purpose and significance, and their voluntary and anonymous participation. They could withdraw at any time without consequences. The data were secure and confidential, and only the researcher accessed them. The data were only for this study, and the findings were reported honestly and accurately.

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The Effect of Designing, Implementing and Evaluating the Pre-Internship Test Using the OSCE Method on Self-Efficacy in the Clinical Performance of Nursing Students

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Abstract

Background: Nursing students play a key role in providing care, improving patient health, and making the healthcare system more effective in the future. Therefore, it is important to prepare students in this field to deliver quality care as future nurses. Clinical education can enhance clinical self-efficacy and facilitate appropriate decision-making in nursing students during clinical situations.

Objectives: The aim of this study was to determine the effect of a pre-internship test via an objective structured clinical examination (OSCE) on self-efficacy in clinical performance among nursing students.

Methods: This single-group quasi-experimental study with a pre- and post-test design was conducted in three steps: design, implementation, and evaluation of the OSCE pre-internship test for undergraduate nursing students. First, a pre-test was administered, followed by student participation in educational workshops. Two weeks later, a post-test was conducted. The evaluation was based on Kirkpatrick's 4-stage model. Data were collected using self-efficacy questionnaires in clinical performance and self-reported feedback from the students. Data analysis was performed using Spearman's, Wilcoxon's, and Friedman's repeated measures tests in SPSS software, with $p < 0.05$ considered the significance level.

Results: The mean scores for the eight stations, as well as the scores for each station individually, increased significantly from the pre-test to the post-test stages ($P < 0.001$). The mean total score of self-efficacy in clinical performance increased significantly from before the pre-test (79.44 ± 10.29) to immediately after the post-test (100.00 ± 15.98) and three months later (133.96 ± 15.53), with $P < 0.001$. A significant relationship was observed between the students' GPA in the 7th semester and their pre-internship exam score in the post-test phase ($P = 0.001$), self-efficacy in clinical performance immediately post-test ($P = 0.001$), and at three months post-test ($P = 0.007$). Most nursing students provided positive feedback regarding the test.

Conclusion: Performing the OSCE pre-internship test is effective in promoting students' clinical performance and self-efficacy. Therefore, it is suggested to include this exam in the nursing curriculum at the end of the sixth semester.

Keywords: Objective Structured Clinical Examination; Pre-Internship Test; Self-Efficacy, Clinical Performance; Nursing Student

Background

Improving the quality of the care system is an important factor affecting patient health and safety (1, 2). In this context, the care system needs efficient nurses equipped with problem-solving and clinical

decision-making skills (1, 3). As appropriate clinical training can enhance self-efficacy (4), preparing students as future nurses is crucial for recognizing patients' educational needs and providing safe care (5, 6).

Bandura defined self-efficacy as a person's belief in their ability to perform effectively in their roles (7). Self-efficacious individuals adapt to the requirements of specific situations, whereas those with low self-efficacy face serious challenges when performing certain tasks (1). For this reason, nursing students with higher self-efficacy are more willing to engage in nursing care (8).

Self-efficacy in the clinical performance of nursing students reflects the educational standards of nursing schools (4). Improving the knowledge, skills, and attitudes of nursing students is considered vital to ensure safe practice and to uphold clinical standards through training and proper evaluation of clinical practice (9, 10). Therefore, it is necessary for nursing instructors to enhance students' professional knowledge and skills via innovative teaching and evaluation methods (11). In this context, nursing instructors focus on adopting teaching and evaluation methods that integrate students' theoretical knowledge with clinical skills in practical settings. One of the main approaches is to conduct a pre-internship exam using an objective structured clinical examination (OSCE) (12, 13).

In the new nursing curriculum, final-year undergraduate students are present in the hospital and at the patient's bedside. Therefore, improving skills such as self-efficacy through workshops is necessary. In addition, evaluation via pre-internship tests can assess hidden skills, such as self-efficacy, provide timely and appropriate feedback, and increase students' awareness of their strengths and weaknesses in clinical settings. This approach gives students an opportunity to work on their skills and competence before entering clinical environments (14). In fact, pre-internship tests and workshops assess skills that students cannot acquire through written exams (15, 16).

In Iran, nursing students participate in a comprehensive exam before graduation, and some nursing schools conduct an OSCE pre-internship exam prior to the internship course (10).

OSCE refers to the evaluation of students' competence using simulated clinical scenarios (17) that focus on observable behaviors (18). Globally, OSCE is used in nursing curricula to measure clinical competence; nevertheless, it is a relatively new addition to Iran's nursing curriculum (10). The simulated nature of OSCE allows students to envision the clinical environment and understand the practical application of their knowledge (17). It also provides an opportunity for students to practice clinical decision-making skills in a safe setting, without compromising patient safety (19). Dr. Ronald Harden first introduced OSCE in

1975 to assess the clinical competence of medical students (20). OSCE is more realistic than written tests and serves as an alternative for evaluating clinical qualifications, with less subjectivity than clinical observation. In OSCE, students are assessed by external examiners as they progress through a series of structured stations with standardized patients to test specific skills such as interviewing, communication, clinical judgment, and physical examination (21).

Considering that self-efficacy is a vital component for independent nursing practice, it seems necessary to develop and implement educational programs that strengthen self-efficacy. Although the effectiveness of educational programs on various outcomes has been proven, their effects on self-efficacy as a key outcome have been less evaluated (7).

Objectives

The present study was conducted with the aim of determining the effect of the design, implementation, and evaluation of the OSCE pre-internship test on self-efficacy in the clinical performance of nursing students before entering the internship.

Methods

Design & Participants: This study was semi-experimental with a one-group pretest-posttest design, conducted on undergraduate nursing students at Qazvin University of Medical Sciences. Inclusion criteria included sixth-semester nursing students, willingness to participate in the study, and obtaining a passing grade in all theoretical and clinical courses. In total, 56 students participated in the study via census.

Intervention

The research was conducted in three steps: design, implementation and evaluation.

First step: design

At this step, scientific and executive committees were created with specific job descriptions. The members of the scientific committee included the dean of the nursing faculty, the vice president of education, the director of the faculty's education development office, the directors of the educational groups, and a faculty member responsible for conducting the exam. All members of the scientific committee had participated in at least one OSCE familiarization workshop. The main tasks of the scientific committee for the exam included providing the table of specifications, checklists, the number of stations and their content, determining the members of the executive committee, establishing the passing score, and

supervising the correct implementation of the exam. The members of the executive committee included the person in charge of conducting the pre-internship test, the person in charge of the education department, the administrative-financial deputy of the faculty, and the examiners of the stations. The tasks of the executive committee included determining the exact time of the exam, scheduling the educational workshops, developing the scenario for each station, ensuring the timely registration of grades for all theoretical courses and internships, preparing the final list of students allowed to participate in the exam, and preparing the exam environment. Analyzing and announcing the results of the exam to the Vice-Chancellor no later than one week after the exam was the responsibility of the executive committee. In addition, the executive committee was obliged to inform the managers of the educational groups about the list of students who failed to achieve a passing score on one or more stations, determine the type and amount of compensatory clinical courses, and report on the planning and implementation of these courses to the vice president of education.

The pre-internship test via OSCE was held at eight stations after the end of the sixth semester exams. The stations included Station 1 (physical examination), Station 2 (airway suction), Station 3 (nasogastric tube insertion), Station 4 (pressure ulcer dressing), Station 5 (infant cardiopulmonary resuscitation), Station 6 (patient education), Station 7 (vaccination), and Station 8 (injections). According to the content of each station, mannequins and simulators were used. Students were asked to demonstrate specific clinical skills at each station. The criteria for passing the test were to acquire at least 70% of the evaluation checklist score in each of the stations. In the case of failure at any station, after coordinating with the director of the nursing department, the student was required to complete an internship unit (equivalent to 51 hours) under the supervision of a professor in the relevant department and obtain a passing grade in the course's practical exam. Each student could participate in the exam for each section a maximum of three times, and in the event of failure to obtain a passing score on the third attempt, the decision regarding the student's academic status was made by the educational council of the college and university.

The second step: implementation

Before the pre-internship exam (pre-test and post-test), a briefing session was held by the member of the academic staff responsible for the exam in the presence

of all students. In the briefing meeting, the approvals of the executive committee meeting, the purpose and necessity of the test, the manner, frequency, time, and place of the test, the characteristics of the stations and their number, the rotation order of the students in the stations, the test resources, the evaluation method, and the criteria for passing the test were all explained. The OSCE pre-internship test was conducted at two times: before and after the workshops. First, the OSCE pre-test was conducted in eight stations. After the completion of student evaluations, educational workshops were held. Following the workshops and two weeks after the pre-test, the OSCE post-test was conducted in eight stations. The purpose of the training workshops was to outline the standards of procedures and the basic principles of care. In the workshops, the content and educational scenarios of each station were deliberately not mentioned. During the pre-exam and post-exam phases, the examiner of each station designed a scenario related to the corresponding station using nursing textbooks. The content validity of the scenarios and the agreement on the items of the checklists were established during several meetings with the OSCE executive committee members and seven faculty members, and the necessary revisions were made. For scoring in the checklists, each item was assigned three points (not performing the procedure = zero, performing the procedure to some extent = one, and performing the procedure completely = three). On the day of the exam (pre-test and post-test), after providing the necessary explanations, students' personal equipment and cell phones were collected by the supervisors, who were part of the administrative staff of the exam center. The students were called to the stations from the large hall of the quarantine center in groups of eight. The test was conducted in the simulation and clinical skills training center of Qazvin University of Medical Sciences under completely standard conditions. This center is equipped with 16 separate rooms as training stations, numerous mannequins and educational mouldages, a dressing room, a large hall for group work or quarantine, as well as a central control room. The time allocated to each station was six minutes. Students took turns moving from one station to another, where a clinical scenario was presented at each station. Students' skills at each station were evaluated by the examiner faculty members using a checklist.

The third step: evaluation

The Kirkpatrick model was used to evaluate the effect of the OSCE pre-internship test. This model

proposes a four-stage evaluation that includes reactions, learning, behavior, and results. The first level describes the attitudes and satisfaction of the participants regarding the learning activity, which can be assessed via a survey of the participants in order to evaluate their subjective response to the test. The second level measures the change in the learning of the participants, which is evaluated by better performance in the post-test or improved performance in the exams. In addition, the correlation between the OSCE score and clinical performance can be examined. The third level assesses the change in clinical behavior and performance, which is evaluated by clinical educators. The fourth level represents the final result, which educational design leads to improved patient care. It is usually difficult to measure this level (22, 23).

1- Examining students' reaction: The attitude and satisfaction of the students toward the OSCE exam were evaluated using a questionnaire to measure the students' feedback. This questionnaire was designed based on a literature review and then presented to 10 nursing lecturers of Qazvin University of Medical Sciences for content and face validity. After approving the validity, a final 17-item self-report questionnaire with a two-point Likert scale (agree, disagree) was designed.

2- Students' learning: The students' learning was evaluated by comparing the total pre-internship score and the score of each station separately in the pre-test and post-test. The correlation between the pre-internship test score in the post-test and the self-efficacy scores for the students' clinical performance was evaluated immediately after the post-test and three months later. The correlation between the pre-internship test score in the post-test and the students' 7th-semester GPA was also measured. Self-efficacy in the clinical performance of the nursing students as an outcome variable was evaluated and compared at three time points of measurement: before the pre-test, immediately after the post-test, and three months after the post-test (in the middle of the 7th semester) using the self-efficacy questionnaire in clinical practice. This questionnaire was designed and psychometrically evaluated in 2009 by Cheraghi and colleagues in Iran. The questionnaire has 37 questions in four subscales of patient assessment (12 items), nursing diagnosis and planning (9 items), implementation (10 items), and evaluation (6 items). Each item is given a score from 1 (I'm not sure) to 4 (I'm sure), and the total score ranges from 37 to 148, where a higher score indicates greater self-efficacy. Cronbach's alpha coefficient ($\alpha = 0.96$)

showed adequate internal consistency of the final instrument, and the retest with a two-week interval indicated adequate stability of the instrument ($r = 0.94$) (24). In the present study, the Cronbach's alpha coefficient of the questionnaire was 0.84, and the retest showed its appropriate stability ($r = 0.91$).

3- Change in students' behavior: In this research, the correlation was examined between pre-internship test scores in the post-test and the self-efficacy assessment of the students' clinical performance at the third time point, measured three months after the post-test. In addition, self-efficacy scores for the students' clinical performance were compared at three measurement points.

4- Results: In the present study, the relationship between the pre-internship test score in the post-test and the students' 7th-semester GPA was evaluated. In addition, the correlation between the students' 7th-semester GPA scores and their self-efficacy scores in clinical practice was examined immediately after the post-test and three months later (Figure 1).

Data Analysis: Mean and standard deviation were used to describe quantitative variables, while frequency and percentage were used to describe qualitative variables. Data distribution was determined via histogram and the Kolmogorov-Smirnov test. Spearman correlation, Wilcoxon tests, and Friedman's repeated measures tests were used to analyze the data. Data were analyzed using SPSS software version 26 (IBM Corporation, Armonk, NY). A p-value of > 0.05 was considered the significance threshold.

Results

In this study, 56 students were evaluated. Of the participants, 53.6% (30 people) of the participants were female, with an average age of 23.0 ± 3.7 years and a GPA of 18.1 ± 1.2 in the 7th semester.

Table 1 shows the students' feedback about the pre-internship test. The majority had a positive understanding of the test. The students perceived the OSCE pre-internship examination as a useful educational test and learning opportunity that adequately linked theory to clinical practice. Most of the students stated that the test included the content and clinical skills taught in the previous semesters. In addition, the students considered the test to be fair. They stated that they were fully informed about the conduct, nature, objectives, and importance of the test before the test.

The participants described the behavior of the examiners, the number of stations, and the location of

the exam as appropriate. Most of the students pointed out that the test was less stressful than traditional tests. Nevertheless, 30.4% of the students considered it a stressful test.

The findings showed a significant increase in the mean scores of eight stations as well as the score of each station separately in the pre-test and post-test ($P < 0.001$). The highest and lowest mean scores were related to the physical examination stations (3.51 ± 0.63) and vaccination (1.83 ± 0.20), respectively (Table 2).

The findings showed an increase in the mean total score of self-efficacy in clinical practice before the pre-test (79.44 ± 10.29), immediately after the post-test (100 ± 15.98), and three months after the post-test (133.96 ± 15.53). The increase in the mean scores across all subscales and the total score of self-efficacy in clinical practice was significant ($P < 0.001$) (Table 3 and Figure 2).

Table 4 presents the relationship between the students' self-efficacy scores and their pre-internship test scores after the post-test. As expected, before performing the pre-test and participating in the workshops, there was no significant relationship between the self-efficacy scores in clinical practice and the pre-test ($P = 0.405$); however, a positive correlation was found between scores immediately after the post-test ($P < 0.001$) and three months later ($P = 0.007$).

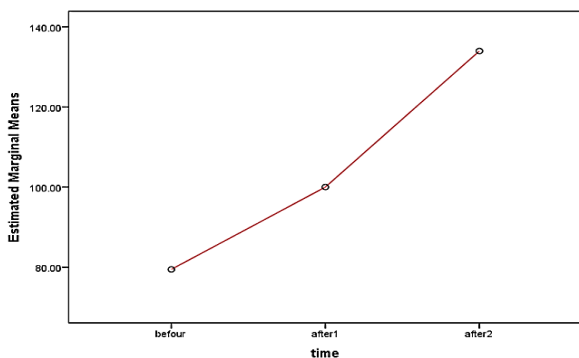


Figure 2. Trend of change in self-efficacy scores for students' clinical performance before the pre-test, immediately after the post-test, and three months after the post-test

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In Table 5, the relationship between the students' 7th-semester GPA and the desired variables is presented. A significant positive relationship was found between the pre-internship exam score in the post-exam stage and the students' 7th-semester GPA. Therefore, it seems that the pre-internship test in the 6th semester, along with educational workshops, can improve the academic achievement of students in the 7th semester. In addition, a significant positive relationship was observed between self-efficacy in clinical practice immediately after the post-test and three months later and the 7th-semester GPA. This suggests that the increase in self-efficacy in clinical practice led to improved performance among the nursing students in the 7th semester. Over time, many factors can play a role in enhancing students' performance; therefore, this finding requires repeating similar studies with longer follow-up periods (Table 5).

Discussion

The main goal of nursing education is to train competent nurses and help students increase self-confidence and self-efficacy. The findings showed a significant increase in the mean scores of all stations and the scores of each station separately in the pre-test and post-test. Therefore, the effectiveness of the OSCE pre-internship test and educational workshops on the students' learning was confirmed. In a systematic review, Vincent et al. reported that students and instructors worldwide consider the correct implementation of the OSCE to be a more realistic and valid method of assessing

student clinical ability (16). Kirwan et al., in a meta-synthesis study of midwifery students' views on the OSCE exam, stated that the OSCE should be administered when students have learned basic nursing skills before entering clinical practice. This will help them remember the main clinical techniques at the patient's bedside. In addition, they emphasized the importance of providing opportunities for students to learn to practice with other students under the supervision of the instructor, familiarizing themselves with the equipment in the OSCE environment, and conducting a mock OSCE test to prepare students for the main test (17).

In the present study, the OSCE test was used as a learning and evaluation tool. A mock OSCE test was conducted as a pre-test to evaluate the clinical performance of the students before participating in the OSCE pre-internship test (post-test), which served as the main test, and feedback was given to the students. Between the pre-test and post-test, in order to improve learning, practice sessions were held in the OSCE environment, and educational workshops were conducted by the examiners. These preparations led the students to be satisfied with the pre-internship test and to consider it an opportunity to learn. In the current study, the implementation of the pre-internship test resulted in a significant increase in self-efficacy in clinical performance at three measurement points. Supporting our findings, Montgomery et al. reported that the OSCE is a valuable evaluation and learning tool for developing nurses' knowledge, clinical skills, confidence, competence, and self-efficacy, so that students can effectively perform their professional roles (25). In another study, the relationship between the students' self-efficacy scores and OSCE scores showed that this test can provide rich learning experiences despite being stressful. In other words, self-efficacy protects students from the negative effects of stress and anxiety on their clinical performance (12). According to the principles of Bandura's self-efficacy theory, if nursing students have high self-efficacy, they will have a greater ability to perform psychomotor skills. Dynamic self-efficacy is created by reacting to four sources of information: performing a behavior, observing others, receiving feedback, and controlling emotions such as stress and anxiety during a procedure. These sources of information show that performance has a significant influence on self-efficacy (26). Contrary to the findings of the present study, some previous studies found that, despite the satisfaction and improved clinical performance of students after taking the OSCE exam compared to traditional teaching methods, the students'

self-efficacy scores did not show a significant increase (19, 27).

This difference in findings may be due to variations in the clinical environments of different countries.

In the current research, most of the nursing students perceived the OSCE pre-internship test as a useful educational tool that provided an opportunity for learning by reducing the gap between theory and clinical practice. The results of previous research have shown that the OSCE evaluation method is a satisfactory experience for evaluating clinical competence and should be implemented repeatedly during students' education (16, 28, 29). The evaluator's behavior can play a key role in improving students' performance during the test. In the present study, the participants evaluated the behavior of the examiner as appropriate and fair. Meanwhile, in Alkhateeb et al.'s study, students were dissatisfied with the examiner's discrimination and unfair behavior during the exam (30). In another study, students mentioned that direct observation by examiners during the exam, through the transfer of negative or positive impulses, can decrease or increase their self-confidence. Therefore, it is necessary for evaluators to receive sufficient training about the OSCE before conducting the test (31). In the present study, to address the aforementioned limitations, scientific and executive committees were formed with specific job descriptions.

The majority of our students stated that the pre-internship test was less stressful than other tests. The results of Vincent et al.'s research showed that students experienced less exam anxiety in the OSCE compared to traditional evaluation methods (16), which was consistent with the findings of the present study. Nevertheless, about a third of the students in the present study considered participating in the OSCE a stressful experience. Unusual and excessive stress causes disturbances in mental processes (32) and can prevent the demonstration of real competence, thereby impairing the validity of the OSCE. In addition, a high level of anxiety can disrupt students' ability to learn from the test and cause a decrease in self-confidence (12). Raziani et al. recommended using methods to reduce the anxiety and worry of nursing students regarding the OSCE. These included providing opportunities for students to prepare, repeated practice sessions, holding a mock test similar to the main test, or conducting preliminary workshops and question-and-answer sessions (31). In the present study, the aforementioned strategies were considered in the implementation of the OSCE pre-internship test. Most of the students stated

that the time allocated to each station was suitable, which could be attributed to the pre-test. Holding a mock OSCE test helps allocate more realistic time for each station, reduce stress, and enhance students' understanding of the test (21).

Strengths and Limitations: One strength of the present study was that the OSCE pre-internship test was conducted at two points (pre-test and post-test), which had a positive effect on the high preparation of the students before the main test. This led to positive feedback and increased the students' satisfaction regarding the implementation of the test. Another strength was holding the test in the clinical skills simulation center, which had a standard building and was equipped with the latest mannequins and moulages. Among the limitations of the present study, the small number of the participants due to the nature of the study can be noted, and it is suggested that a study be conducted with a larger sample size to increase generalizability.

Conclusion

The present study showed that the correct implementation of the OSCE pre-internship test can have a positive effect on the self-efficacy of students' clinical performance. Therefore, it is suggested that this method of teaching and evaluation be given more attention in the nursing curriculum. In addition, holding the OSCE pre-internship exam at the end of the sixth academic semester should be included in the nursing curriculum. To reduce students' stress and improve results, it is suggested that the OSCE be conducted in accordance with the standards several times during the four-year education period. The present study can serve as a guide for conducting the pre-internship test in other faculties.

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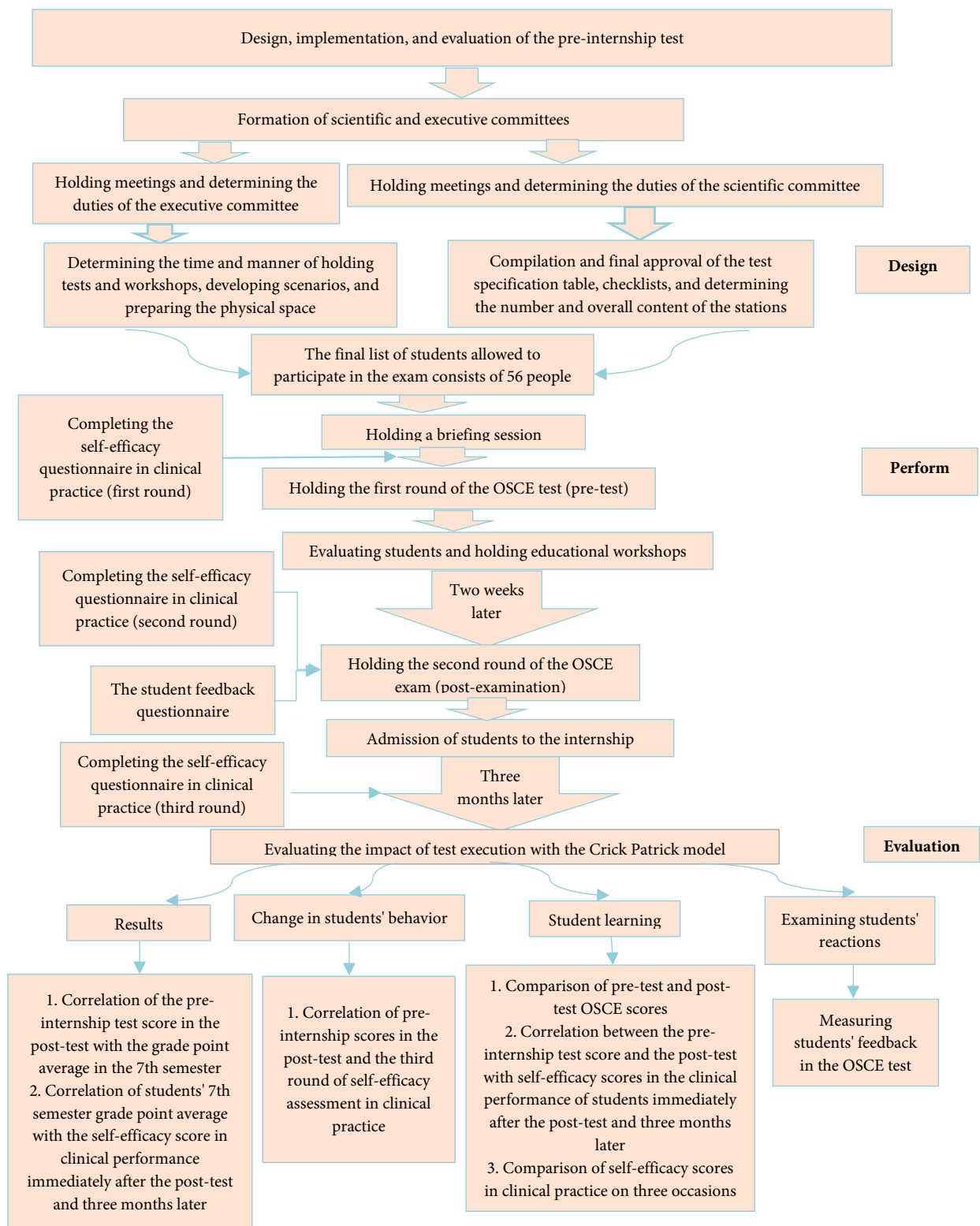


Figure 1. Design, implementation, and evaluation of the pre-internship test

Table 1. Frequency (Percentage) of Nursing Students' Feedback on Test Implementation

Row	Objects	Agree	Disagree
1	The test included content and clinical skills taught in previous semesters.	54 (96.4)	2 (3.6)
2	The objectives and importance of the test were clear.	49 (87.5)	7 (12.5)
3	Sufficient information was provided regarding the nature and manner of conducting the test.	51 (91.1)	5 (8.9)
4	The number of test stations was proportional.	48 (85.7)	8 (14.3)
5	The venue of the exam was suitable.	48 (85.7)	8 (14.3)
6	The time allocated to each station was appropriate.	44 (78.6)	12 (21.4)
7	The way of asking questions in different stations was appropriate.	41 (73.2)	15 (26.0)
8	Compared to other tests, it was less stressful.	39 (69.6)	17 (30.4)
9	The evaluator's behavior was appropriate.	51 (91.1)	5 (8.9)
10	The test was fair.	46 (82.2)	10 (17.9)
11	The test was a good scale for measuring clinical skills.	36 (64.3)	20 (35.7)
12	It led to an increase in the confidence of the student to enter the bed.	39 (69.7)	17 (30.3)
13	It led to the increase of the student's decision-making power in critical situations at the bedside.	38 (67.9)	18 (32.1)
14	It revealed the weak points of the student in clinical skills.	38 (67.9)	18 (32.2)
15	She communicated the theory to the bedside.	51 (91.1)	5 (8.9)
16	It provided an opportunity to learn.	48 (85.7)	8 (14.3)
17	All in all, it was a useful practical test.	49 (87.5)	7 (12.5)

Table 2. Comparison of Nursing Students' OSCE Pre-Test and Post-Test Scores by Station Type

Station name	OSCE Pre-Examination			After the OSCE exam			P value
	Mean (SD)	Middle	Interquartile range (Q3-Q1)	Mean (SD)	Middle	Interquartile range (Q3-Q1)	
Physical examinations	2.12 (0.65)	2	1	3.51 (0.63)	3.75	0.75	< 0.001
Airway suction	1.43 (0.51)	1.5	1	2.89 (0.15)	3	0.25	< 0.001
Nasogastric tube	0.92 (0.25)	1	0.188	1.96 (0.08)	2	0	< 0.001
Neonatal resuscitation	1.00 (0.31)	1	0	1.99 (0.04)	2	0	< 0.001
Wound dressing and care	0.99 (0.04)	1	0	1.95 (0.12)	2	0	< 0.001
Patient education	0.90 (0.28)	1	0.25	1.84 (0.02)	1.90	0.19	< 0.001
Vaccination	0.84 (0.22)	1	0.25	1.83 (0.02)	2	0.25	< 0.001
Injections	1.66 (0.40)	1.75	0.5	2.95 (0.10)	3	0	< 0.001
Total score of stations	9.88 (0.93)	9.75	1.25	18.95 (1.15)	19.40	1.25	< 0.001

Statistical test: Wilcoxon signed-rank test

Table 3. Comparison of Self-Efficacy Scores in Clinical Performance Before the Pre-Test, Immediately After the Post-Test, and Three Months After the Post-Test

Station name	Before the pre-examination			Immediately after the post-test			Three months after the post-test			P value
	Mean (SD)	Middle	Interquartile range (Q3-Q1)	Mean (SD)	Middle	Interquartile range (Q3-Q1)	Mean (SD)	Middle	Interquartile range (Q3-Q1)	
Patient assessment	25.58 (3.28)	24	3	34.73 (6.19)	36	9	43.08 (4.28)	44	7	< 0.001
Diagnosis and planning	19.25 (2.62)	18	2	25.64 (4.90)	27	7	32.98 (6.72)	33	6	< 0.001
perform	21.82 (3.36)	20	4	22.32 (3.33)	21	4	36.12 (3.35)	37	5	< 0.001
Evaluation	12.78 (2.00)	12	1	17.28 (3.44)	18	4	22.17 (6.19)	22	4	< 0.001
Self-efficacy total score	79.44 (10.29)	75	9	100.00 (15.98)	101	19	133.96 (15.53)	134	68.124	< 0.001

Statistical test: repeated measures (Friedman test)

Table 4. Correlation Between Pre-Internship Test Scores and Post-Test Self-Efficacy in Clinical Performance Before the Pre-Test, Immediately After the Post-Test, and Three Months After the Post-Test

Variables		Spearman's correlation coefficient	CI (0.95)	P value
Pre-internship exam score	Self-efficacy in clinical performance before the pre-test	$r = 0.113$	(-0.179-0.366)	0.405
	Self-efficacy in clinical practice immediately after the post-test	$r = 0.420$	(0.171-0.625)	< 0.001
	Self-efficacy in clinical performance three months after the post-test	$r = 0.356$	(0.073-0.598)	0.007

Table 5. Correlation Between Students' Grade Point Average Scores in the 7th Semester, Pre-Internship Test Scores, Post-Test Scores, and Self-Efficacy in Clinical Practice

Variables		Spearman's correlation coefficient	CI (0.95)	P value
Grade point average in the 7th semester	The pre-internship test score in the post-test	$r = 0.554$	(0.414-0.709)	< 0.001
	Self-efficacy in clinical practice immediately after the post-test	$r = 0.179$	(-0.123-0.459)	0.187
	Self-efficacy in clinical practice three months after the post-test	$r = 0.224$	(-0.032-0.505)	0.048

Integrating Basic Electrocardiogram Interpretation into Advanced Cardiovascular Life Support Stations Through Simulation-Based Learning Among Preclinical Medical Students: Comparing Student and Teacher Perceptions

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Abstract

Background: Simulation-based learning (SBL) was introduced at Phramongkutklao College of Medicine to improve electrocardiogram skills within an advanced cardiovascular life support (ACLS) context for pre-clinical students.

Objectives: This study compared the perceptions of third-year students and teachers regarding the SBL course.

Methods: A cross-sectional study included 96 students and 10 instructors. The course featured five stations to assess ECG interpretation, ACLS management, and pharmacological knowledge. The questionnaire included sections on demographics, a 5-point Likert scale to assess satisfaction with preparation, effectiveness, scenarios, equipment, and perception, as well as open-ended questions to explore pros and cons. Internal reliability, construct validity (exploratory factor analysis: EFA), and content validity (item objective congruence: IOC) were assessed. Responses were analyzed using Mann-Whitney U-tests, and open-ended questions underwent content analysis. Stata 17.0 was used for analysis, and $p < 0.05$ was considered significant.

Results: Eighty-nine students and 10 instructors responded to the questionnaire. Cronbach's alpha for the satisfaction and perception sections were 0.91 and 0.97, respectively. IOC ranged from 0.67 to 1.00, and EFA confirmed unidimensionality (Eigenvalue1: Eigenvalue2 = 9.31:0.55, $\lambda = 0.55-0.91$). The participants responded positively to the preparation resources and course effectiveness. Median (IQR) scenario-difficulty scores were 5.00 (4.00-5.00) for the students and 3.50 (3.00-4.00) for the instructors ($p < 0.001$), and perception scores were 4.93 (4.43-5.00) for the students and 4.32 (4.00-4.57) for the instructors ($p = 0.021$). Content analysis showed that the students valued comprehensiveness and realism but wanted more pre-training. The instructors noted high resource use and information sharing by the morning group tested first, which influenced the afternoon groups and resulted in bias.

Conclusion: The SBL course met learning objectives with high satisfaction and was perceived as effective. The participants agreed that it enhanced knowledge but suggested adding a peer-led mock exam to boost confidence and increasing parallel cases to reduce bias.

Keywords: Simulation; Simulation-Based Learning; ACLS; Electrocardiogram; Medical Student

Background

Electrocardiography (EKG) is a crucial skill in medical practice (1) and is used for screening and diagnosing cardiac diseases, including life-threatening disorders (2). Accurate interpretation of EKGs by

medical specialists dramatically improves treatment outcomes, especially in cases of acute myocardial infarction or cardiac arrest (3). Traditionally, EKG interpretation skills are taught through lectures that focus on principles but lack real-world interpretation

practice, resulting in students lacking confidence in systematic interpretation (4).

Simulation-based learning (SBL) is a widely used teaching method in medical education (5). As an innovative tool, simulation involves practically emulating scenarios or events for learning, assessment, or research purposes (6). With the expansion of medical knowledge and limited training time, simulation increasingly bridges the traditional apprenticeship model and the need for skills training in modern medicine (6). Learning through realistic simulated scenarios allows medical students to acquire skills using mannequins or other tools before applying this knowledge to real patients (7). This approach provides a safe, controlled environment that enriches experiences and enhances students' confidence and decision-making abilities, ultimately improving their clinical and related skills (7).

Previous studies have reported positive outcomes in enhancing knowledge, skills, and attitudes toward technology-enhanced simulation (8). Research conducted in the United States using SBL to teach 89 fourth-year medical students advanced cardiovascular life support (ACLS) found significant improvements in their knowledge scores after simulation cases and a notable increase in their confidence scores after the simulated experience (6). Implementing SBL within emergency medicine (EM) training programs has created tremendous opportunities for optimizing educational delivery (9). Furthermore, SBL has demonstrated superiority in EKG learning compared to traditional methods (10).

Despite the benefits of SBL and ACLS in improving EKG learning, several schools still teach EKG interpretation using traditional methods and without a simulated environment (3, 11). Furthermore, limited research has focused on the perceptions of undergraduates, particularly preclinical medical students, regarding the effectiveness of SBL strategies (5). Gauging students' satisfaction with this teaching method is crucial to effectively integrate SBL into medical education curricula (5). Student satisfaction is pivotal to their ability to learn and practice clinical skills in a controlled environment before engaging with real patients (12). Integrating the voices of students and stakeholders is important for improving the learning course in future iterations (13).

Although ACLS learning can potentially improve EKG interpretation skills, most medical students take ACLS

courses during their late clinical years (14). Hence, Phramongkutklao College of Medicine (PCM) developed an SBL course focusing on EKG interpretation and advanced lifesaving skills for pre-clinical medical students, with approximately 100 participants enrolled. SBL was integrated into EKG interpretation and ACLS management through scenarios featuring ACLS mannequins. The medical students applied their knowledge to various case studies in simulated scenarios. This study evaluated the students' satisfaction and perceptions toward SBL in the EKG interpretation course while comparing these perspectives with those of teachers. In addition, comprehensive details on the course implementation and the obstacles encountered were depicted. The findings can be instrumental in designing future training and implementing simulated activities for pre-clinical medical students.

Objectives

This study compared the perceptions of third-year students and teachers regarding the SBL course.

Methods

The present study employed a cross-sectional design to survey all students and teachers who participated in integrating basic electrocardiogram interpretation into ACLS stations through an SBL course. The study's report on SBL interventions adhered to the STROBE statement and its extension for reporting simulation-based research (Appendix 1) (15, 16).

Study Design and Subject: A sample size of 52 was required for an effect size of 0.82 with 80% power at a significance level of 0.05 for a two-sample Wilcoxon rank-sum (Mann-Whitney) test using G*Power 3.1.9.7 (17, 18). The course involved 96 third-year medical students and 10 PCM instructors. A cross-sectional study was conducted to collect perceptions of the course. At the end of the class, 89 students and all instructors responded to the questionnaire, totaling 99 responses. A course on integrating SBL into basic EKG interpretation and ACLS management was conducted. The course took place in the third trimester of the cardiovascular system block at PCM's simulation center. At the course's conclusion, the students and instructors completed a questionnaire to gauge their satisfaction and perspectives regarding SBL in basic EKG interpretation using an ACLS high-fidelity mannequin. [Figure 1](#) illustrates the stages of the SBL course on basic EKG interpretation using an ACLS high-fidelity mannequin.

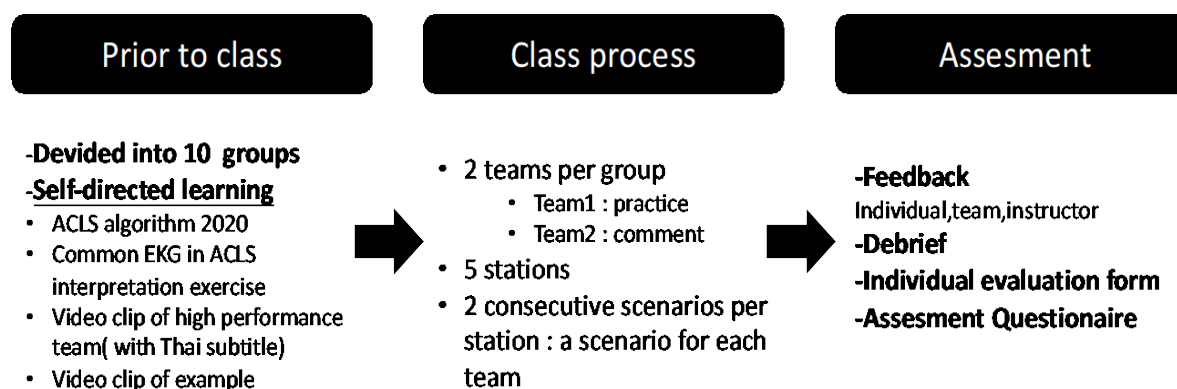


Figure 1. Stages of the SBL course on basic EKG interpretation using an ACLS high-fidelity mannequin

The course is divided into three stages:

1. Prior to the Course

The students received instruction on basic EKG interpretation through lectures. Additionally, they were provided with ACLS guidelines and an EKG review exercise for self-directed learning. A video clip demonstrating the use of the ACLS mannequin and an introductory demonstration of ACLS management were also conducted and distributed to the students for course preparation. Alpha and beta tests were conducted to verify the scenario's feasibility, difficulty, and assessment criteria. The alpha test involved two intern doctors who are now teaching assistants at PCM and hold ACLS certifications. Subsequently, five fourth-year medical students participated in the beta test. Based on feedback from EM staff, the authors refined the scenarios accordingly.

2. During the Course

Ninety-six third-year medical students were divided into 10 groups, each comprising 9-10 students. The groups were further divided into two sessions, with five groups participating in the morning and the other five in the afternoon. All student groups rotated through five stations, each featuring two consecutive scenarios. Each station lasted 30 minutes and had two instructors providing suggestions and learning summaries.

Each group was divided into two subgroups, consisting of five students each, designated as Leader, Airway Manager, Compressor, Nurse, and Recorder. The subgroups were further separated into hands-on groups (subgroup1) and observation groups (subgroup2) to express their opinions. Each subgroup had 10 minutes to perform the simulated scenario. The Leader ran the algorithm, supervised medications, and answered instructor questions verbally. Then, the subgroups switched roles to run the scenario. Instructors could

assist or demonstrate clinical procedures, such as intubation. Group leaders were evaluated on their EKG interpretation skills, the pharmacological mechanism of action, and their ability to use the ACLS algorithm under examination conditions. Finally, the instructors conducted debriefing sessions on the scenarios.

3. Post Course

After the course, the students and instructors were asked to complete a questionnaire about their satisfaction and perceptions of the course. Additionally, they were asked to provide comments on the pros and cons. The questionnaire was completed via Google Forms, where the participants scanned the QR code or clicked the link to access and complete it. On the first page of the form was an information sheet, which the participants were asked to review carefully. The collected data were then interpreted for further analysis.

Data Collection: The study utilized a 33-item electronic questionnaire divided into three sections: (1) short-answer questions for demographic data (3 items), (2) a 5-point Likert scale to assess satisfaction with skill improvement, course preparation, scenario suitability, and device suitability (4 items each), and (3) perceptions of SBL in EKG interpretation (14 items). The questionnaire also included two open-ended questions to explore the pros and cons of the course, with completion taking approximately 15 to 20 minutes. Skill improvement covered EKG interpretation, ACLS algorithm management, medication selection based on pharmacodynamics and pharmacokinetics, and holistic care. Course preparation included learning resources such as sample videos of medical teams, common EKG examples, ACLS algorithms, and allocated preparation time. Scenario suitability was evaluated based on the number, variety, difficulty, and duration of each scenario. Equipment adequacy was assessed by the quantity and

realism of medical instruments, the complexity of using the high-fidelity mannequin, and the comprehensiveness of the instruction manual. The perception of SBL was gauged using an adapted questionnaire.

Questionnaire Reliability and Validity Analysis: The questionnaire was adapted and translated based on previously published work on satisfaction and perception relevant to this paper, as well as the investigators' experience and the context of PCM (19). Before distribution, three expert instructors reviewed the content of the assessment form using the item objective congruence (IOC) approach to ensure its content validity regarding simplicity, relevance, and language. Each question received an IOC index between 0.67 and 1.00, above the threshold of 0.50, and amendments were made according to the suggestions (Appendix 2) (20). The construct validity of the perception questionnaire was also confirmed through extensive adaptation using exploratory factor analysis. Moreover, Cronbach's alpha was analyzed to determine the questionnaire's reliability.

Statistical Analysis: All data were downloaded from Google Forms, and data analyses were conducted using Stata Statistical Software: Release 17 (Stata Corp, 2021. College Station, TX: Stata Corp LLC). A frequency distribution of demographic characteristics was used to describe the study subjects. Categorical data were presented as percentages, while continuous variables were expressed as means and standard deviations (SD). Due to the violation of the normality assumption, the two-sample Wilcoxon rank-sum (Mann-Whitney) test was used to compare the ratings between the students and teachers on the Likert scale. All statistical tests were two-sided, and a p-value less than 0.05 was deemed statistically significant. The comments regarding the course's pros and cons were analyzed using content analysis, and similar contexts were organized into themes.

Ethics Approval and Consent to Participate: The study was approved by the Medical Department Ethics Review Committee for Research in Human Subjects, Institutional Review Board, RTA (Approval no. S023q/66_Exp), in accordance with international guidelines, including the Declaration of Helsinki, the Belmont Report, CIOMS Guidelines, and the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use - Good Clinical Practice. Documentation of informed consent was obtained, and the Institutional Review Board, RTA Medical Department, granted permission.

Results

Characteristics of Participants: Ninety-six third-year medical students and 10 instructors participated in the study. Of these students, eighty-nine (92.7%) responded to the questionnaire. Approximately 64.0% of the participants were male. More than 40 students (45.0%) spent over 5 hours on course preparation, while only two participants (2.3%) devoted less than an hour to the course preparation. Ten instructors responded, six of whom graduated with a Doctor of Medicine degree and had previous experience with ACLS, while the others were from different health professions, including basic science and pharmacology.

Satisfaction of the Integration of Basic EKG Interpretation into ACLS Stations Through the SBL Course: Table 1 presents the satisfaction levels of the students and instructors with SBL, assessed using a Likert scale. The overall Cronbach's alpha for the satisfaction section is 0.91. Within each satisfaction domain, Cronbach's alphas for skill improvement, course preparation, scenario suitability, and equipment suitability were 0.83, 0.76, 0.86, and 0.89, respectively. The students reported a median (IQR) satisfaction with the learning outcome score of 4.25 (4.00–5.00), while the instructors reported 3.88 (3.75–4.25) ($Z = 1.796$, $p=0.072$, effect size $d = 0.59$). Over 50% of the students strongly agreed that the course enhanced their EKG interpretation skills and ACLS algorithm management. However, more than half of the instructors disagreed that the course effectively improved the students' ability to select pharmacological agents based on pharmacodynamics and pharmacokinetics. Regarding learning resources and allocated preparation time, the median (IQR) scores were 4.50 (4.00–5.00) for the students and 4.50 (4.50–4.75) for the instructors, with both groups generally agreeing that the resources were effective. Regarding scenarios, the students and instructors scored them 4.75 (4.25–5.00) and 4.00 (3.75–4.50), respectively ($Z=3.012$, $p=0.003$, effect size $d=2.06$), with 60% to 70% of the students strongly agreeing on their effectiveness. In contrast, the instructors rated the scenario difficulty less favorably ($Z=3.670$, $p<0.001$, effect size $d=1.38$). Additionally, the students rated their satisfaction with the equipment higher than the instructors, with median (IQR) scores of 5.00 (4.00–5.00) and 3.75 (3.50–4.25), respectively ($Z=3.111$, $p=0.002$, effect size $d=1.06$).

Perception Toward the SBL Course: Exploratory factor analysis was performed with maximum likelihood

extraction and orthogonal (varimax) rotation. Unidimensionality was confirmed in the perception questionnaire (Eigenvalue component 1: Eigenvalue component 2 = 9.31:0.55). The Kaiser–Meyer–Olkin measure of sampling adequacy was applied, yielding an overall index of 0.90, indicating sufficient data for factor analysis. Additionally, Bartlett’s test for sphericity confirmed that the intercorrelation matrix was factorable ($\chi^2 = 1522.51, p < 0.001$). The factor loadings are strong, ranging from 0.55 to 0.91, with all values above 0.30. Moreover, the Cronbach’s alpha for the perception of SBL is 0.97.

Table 2 illustrates perceptions of the SBL course, stratified by the students and teachers. The median (IQR) scores were 4.93 (4.43–5.00) for the students and 4.32 (4.00–4.57) for the teachers, respectively ($Z = 2.314, p = 0.021, \text{effect size } d = 0.82$). Over 96% of the students expressed positive views (strongly agree/agree) about the SBL course. Significant discrepancies emerged between the teachers and students regarding the learners’ ability to apply prior basic skills during simulations, the effectiveness of the course in enhancing practical skills, the realism of the mannequin, and the integration of SBL into the curriculum. Conversely, both groups positively noted that the SBL course improved student communication skills, critical thinking, decision-making abilities, clinical skills and competence, EKG interpretation skills, and ACLS management skills. Figure 2 further depicts the students’ perceptions of the SBL course.

Content Analysis of Pros and Cons: A content analysis of the participants’ comments was conducted. The students indicated that SBL provided a superior understanding compared to traditional learning methods ($N = 27$) and offered practical, realistic simulations that closely mirrored actual clinical practice ($N = 23$). Some students expressed enjoyment and excitement about the course ($N = 11$), while others noted the practical applicability of the experience gained ($N = 7$).

However, concerns were raised about additional lectures and training before the course ($N = 14$). Both students ($N = 8$) and instructors ($N = 3$) also observed discrepancies between morning and afternoon sessions and variations in the difficulty levels across stations ($N = 7$). The instructors highlighted the need for better preparation and prior knowledge to enhance student engagement and noted the substantial resource use, including teaching staff, preparation time, and facilities.

Discussion

The study demonstrated a course that integrated EKG interpretation into an ACLS station for pre-clinical students without experience in patient care. The findings indicated positive satisfaction and perception of SBL among the participants. The students reported considerable contentment with the learning outcomes, including enhanced EKG interpretation skills, proficiency in managing ACLS algorithms, effective medication selection, and comprehensive, holistic care. While the instructors also expressed satisfaction with the learning outcomes, their scores were slightly lower than those of the students. The students expressed a desire for additional lectures and training before the course, and the instructors highlighted the need for improved preparation and prior knowledge among the students. Furthermore, various comments emphasized aspects that could prove beneficial in implementing SBL, including the identification of disparities in the difficulty levels across stations.

Regarding the perception of learning resources, both students and instructors found the provided materials—such as sample videos of medical teams, common EKG examples, and ACLS algorithms—suitable and beneficial for course preparation. The students noted that the SDL resources were particularly helpful, especially for those with lower GPAs, as a study in Oman indicated a preference for SDL among such students (21). This may be because students with higher GPAs already possess prior knowledge before the course. The scenarios used during the SBL course were well-received, with the students rating them highly in terms of quantity, variety, difficulty, and duration. The participants also positively evaluated the equipment’s suitability, noting the adequacy and realism of the medical instruments, the usability of the high-fidelity mannequin, and the thoroughness of the instruction manual.

In terms of perceptions regarding SBL, the students consistently rated higher scores than instructors across all categories. Similar to findings in related studies, the medical students perceived that SBL not only facilitated the integration of their knowledge into clinical practice and elevated their medical skills but also heightened their interest in learning and provided a practical, lifelike experience akin to real clinical settings (22). The lower instructor satisfaction may primarily stem from the belief that pre-clinical students require more knowledge before integrating EKG into workplace-based assessments. Additionally, the substantial use of resources and time was noted. A potential solution could involve providing

formative examinations or peer-led mock practice rounds to enhance student knowledge and confidence before summative assessments (23).

Although this study's findings support prior research on the efficacy of SBL in medical education, it is important to note that SBL requires significant resources and numerous instructors. This can lead to lower instructor satisfaction when conducting the course, presenting a major barrier to adopting active learning methods (24). Thus, applying generalizability theory might be beneficial in determining the optimal number of instructors and scenarios required to achieve reliable assessments (25).

The study examined the participants' perceptions of SBL as a teaching method, indicating its potential to enhance learning experiences and clinical preparedness, while also highlighting a notable disparity in SBL perceptions between the students and teachers, with the teachers generally scoring it lower. Some teachers believed that augmenting SBL with more lecture-based learning (LBL) could improve its effectiveness, a sentiment echoed by students who desired additional lectures and training before SBL courses. While lectures on EKG and ACLS are beneficial, incorporating SBL can motivate students and provide realistic clinical insights for pre-clinical learners. LBL remains essential in undergraduate medical education (26). For instance, an Indian study found that although a lecture-based group outperformed a simulation-based group on MCQ tests in a status epilepticus scenario, the simulation group showed greater confidence in patient management, underscoring SBL's role as an effective complement to LBL (27).

Concerns regarding bias between the morning and afternoon groups were also noted. The afternoon group may receive unauthorized information from the morning group, leading to unfairness. To address this, additional parallel scenarios should be provided for further development to ensure parity between the morning and afternoon groups. Additionally, enhancing the assessment form and determining the appropriate number of teachers needed to achieve reliable assessments would be beneficial.

The instructors did not fully agree that the students could effectively utilize their basic knowledge in the simulated environment, suggesting that more preparation, including high-stakes examinations, is necessary to enhance the course's effectiveness. Future developments should include formative or peer-led examinations. Developing student-friendly rubrics could also help students assess their own or peers'

performance. Rubrics, which delineate explicit performance criteria and expectations, ensure uniform grading, provide targeted feedback, and promote peer assessment (28, 29), could reduce the number of teachers required for formative SBL rounds. Additionally, applying generalizability theory may help determine the optimal number of raters needed for reliable assessments, thereby minimizing resource requirements (25).

It is worth noting that this pilot study has several limitations. Firstly, it was conducted at a single institution with a relatively small sample size, potentially restricting the generalizability of the findings to other medical schools or larger populations. Secondly, since the study was an initial attempt, there were several opportunities for improvement. Further research would provide more substantial evidence regarding the development of the SBL course during the pre-clinical years. Thirdly, implementing SBL requires significant resources, including costs and personnel (30). Therefore, conducting multiple sessions was not feasible in the present study, and comparisons across different sessions were impossible. Fourthly, the number of experts available for content validity in the present study was three, which is the minimum acceptable number for content validity (31). However, this number is considered acceptable since fewer raters are needed to assess the same items in a school district compared to a statewide study. Additionally, when the content domain being rated is narrowly defined, rater agreement tends to be higher, thus requiring fewer raters (32). Lastly, although assessing the retention of knowledge and skills is recommended, it may be challenging due to potential confounding factors encountered throughout the clinical years. Nonetheless, concerns raised, such as disparities between the morning and afternoon groups, variations in the difficulty levels of stations, and the scoring criteria employed by instructors, highlight the need for refinement and optimization in future implementations of the SBL course.

Conclusion

The study investigated the implementation of SBL for EKG interpretation among third-year medical students at PCM, revealing a favorable reception and perception of SBL. The findings underscored the efficacy of SBL in enhancing students' knowledge and proficiency in EKG interpretation and ACLS management. The study supported the incorporation of SBL as a valuable pedagogical approach in medical education curricula,

offering a secure and controlled setting for acquiring clinical skills and bolstering students' confidence and decision-making abilities from the pre-clinical years onward. However, significant resource needs and inadequate student preparation were noted. To address these issues, we recommend developing peer-led practice rounds to enhance confidence and skills, increasing the number of parallel cases with similar difficulty to reduce bias, and assessing knowledge retention in future clinical years.

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Table 1. Student and Teacher Satisfaction with the Integration of Basic EKG Interpretation into ACLS Stations Through the SBL Course

Questions	Profession	5 [n (%)]	4 [n (%)]	3 [n (%)]	2 [n (%)]	1 [n (%)]	Median (IQR)	Z	p-value	
The integration of basic EKG interpretation into ACLS stations through the SBL course to improve these learning outcomes										
EKG interpretation skills	Student	44 (49.4)	34 (38.2)	11 (12.4)	0	0	4 (4-5)	0.689	0.491	
	Teacher	4 (40.0)	4 (40.0)	2 (20.0)	0	0	4 (4-5)			
ACLS management skills	Student	50 (56.2)	33 (37.1)	6 (6.7)	0	0	5 (4-5)	2.046	0.041*	
	Teacher	2 (20.0)	7 (70.0)	1 (10.0)	0	0	4 (4-4)			
Drug selection based on pharmacokinetics and pharmacodynamics	Student	37 (41.6)	36 (40.5)	16 (18.0)	0	0	4 (4-5)	2.117	0.034*	
	Teacher	2 (20.0)	3 (30.0)	4 (40.0)	1 (10.0)	0	3.5 (3-4)			
Holistic care of a patient	Student	38 (42.7)	40 (44.9)	11 (12.4)	0	0	4 (4-5)	0.878	0.380	
	Teacher	3 (30.0)	5 (50.0)	2 (20.0)	0	0	4 (4-5)			
Overall learning outcome Likert score (Median (IQR))	Student	4.25 (4-5)							1.796	0.072
	Teacher	3.88 (3.75-4.25)								
Satisfaction of the self-directed learning resources and the allocated time										
Sample videos/medical team for pre-learning purposes	Student	34 (38.2)	34 (38.2)	19 (21.3)	1 (1.1)	1 (1.1)	4 (4-5)	-0.884	0.377	
	Teacher	4 (40.0)	6 (60.0)	0	0	0	4 (4-5)			
Common EKG examples	Student	54 (60.7)	26 (29.2)	7 (7.9)	2 (2.2)	0	5 (4-5)	0.020	0.984	
	Teacher	6 (60.0)	3 (30.0)	1 (10.0)	0	0	5 (4-5)			
ACLS algorithms for pre-learning purposes	Student	55 (61.8)	26 (29.2)	6 (6.7)	2 (2.2)	0	5 (4-5)	-1.218	0.223	
	Teacher	8 (80.0)	2 (20.0)	0	0	0	5 (5-5)			
The amount of time for preparation before class is appropriate	Student	45 (50.6)	35 (39.3)	7 (7.9)	1 (1.1)	1 (1.1)	5 (4-5)	0.528	0.597	
	Teacher	4 (40.0)	5 (50.0)	1 (10.0)	0	0	4 (4-5)			
Overall learning resource Likert score (Median (IQR))	Student	4.5 (4-5)							-0.390	0.696
	Teacher	4.5 (4.5-4.75)								
Satisfaction with the scenarios and equipment										
Number of scenarios	Student	57 (64.0)	32 (36.0)	0	0	0	5 (4-5)	1.690	0.091	
	Teacher	4 (40.0)	5 (50.0)	1 (10.0)	0	0	4 (4-5)			
The diversity of the scenarios	Student	63 (70.8)	25 (28.1)	1 (1.1)	0	0	5 (4-5)	2.703	0.007*	
	Teacher	3 (30.0)	6 (60.0)	1 (10.0)	0	0	4 (4-5)			
The difficulty of the scenarios	Student	54 (60.7)	28 (31.5)	7 (7.9)	0	0	5 (4-5)	3.670	<0.001*	
	Teacher	1 (10.0)	4 (40.0)	5 (50.0)	0	0	3.5 (3-4)			
The duration of each scenario	Student	54 (60.7)	27 (30.3)	7 (7.9)	1 (1.1)	0	5 (4-5)	1.880	0.060	
	Teacher	3 (30.0)	5 (50.0)	2 (20.0)	0	0	4 (4-5)			
Overall scenarios Likert score (Median (IQR))	Student	4.75 (4.25-5)							3.012	0.003*
	Teacher	4 (3.75-4.5)								
Satisfaction with the equipment										
Number of pieces of equipment	Student	57 (64.0)	24 (27.0)	7 (7.9)	1 (1.1)	0	5 (4-5)	2.598	0.009*	
	Teacher	2 (20.0)	6 (60.0)	2 (20.0)	0	0	4 (4-4)			
The equipment is realistic	Student	59 (66.3)	25 (28.1)	5 (5.6)	0	0	5 (4-5)	2.371	0.018*	
	Teacher	3 (30.0)	5 (50.0)	2 (20.0)	0	0	4 (4-5)			

The level of difficulty in handling the high-fidelity mannequin is appropriate	Student	59 (66.3)	22 (24.7)	7 (7.9)	1 (1.1)	0	5 (4-5)	3.118	0.002*
	Teacher	2 (20.0)	4 (40.0)	4 (40.0)	0	0	4 (3-4)		
Teaching and learning manual	Student	53 (59.6)	28 (31.5)	8 (9.0)	0	0	5 (4-5)	2.356	0.019*
	Teacher	2 (20.0)	6 (60.0)	2 (20.0)	0	0	4 (4-4)		
Overall equipment Likert score (Median (IQR))	Student	5 (4-5)						3.111	0.002*
	Teacher	3.75 (3.5-4.25)							

5: Strongly agree, 4: Agree, 3: Mediocre, 2: Disagree, 1: Strongly disagree, ACLS: Advanced Cardiovascular Life Support, EKG: electrocardiogram, SBL: simulation-based learning, *p<0.05

Table 2. Student and teacher perception on the Integration of basic EKG interpretation into ACLS stations through the SBL course

Questions	Profession	5	4	3	2	Median (IQR)	Z	p-value
Experience with the simulation benefits clinical practice	Student	68 (76.4)	21 (23.6)	0 (0)	0 (0)	5 (5-5)	1.947	0.052
	Teacher	5 (50.0)	4 (40.0)	1 (10.0)	0 (0)	4.5 (4-5)		
The learner was able to utilize prior basic skills during the simulation	Student	67 (75.3)	22 (24.7)	0 (0)	0 (0)	5 (5-5)	2.655	0.008*
	Teacher	4 (40.0)	4 (40.0)	2 (20.0)	0 (0)	4 (4-5)		
The simulation course improves the learner teamwork skills	Student	65 (73.0)	21 (23.6)	3 (3.4)	0 (0)	5 (4-5)	2.001	0.045*
	Teacher	4 (40.0)	6 (60.0)	0 (0)	0 (0)	4 (4-5)		
The simulation course improves the learner communication skills	Student	63 (70.8)	24 (27.0)	2 (2.2)	0 (0)	5 (4-5)	2.051	0.040*
	Teacher	4 (40.0)	5 (50.0)	1 (10.0)	0 (0)	4 (4-5)		
The simulation course improves the learner critical thinking and decision-making skills	Student	67 (75.3)	19 (21.3)	3 (3.4)	0 (0)	5 (5-5)	1.573	0.116
	Teacher	5 (50.0)	5 (50.0)	0 (0)	0 (0)	4.5 (4-5)		
The simulation course improves the learner clinical skills and competence	Student	69 (77.5)	18 (20.2)	2 (2.2)	0 (0)	5 (5-5)	1.308	0.191
	Teacher	6 (60.0)	3 (30.0)	1 (10.0)	0 (0)	5 (4-5)		
The simulation course improves the learner practical skills	Student	67 (75.3)	19 (21.3)	3 (3.4)	0 (0)	5 (5-5)	3.393	<0.001*
	Teacher	2 (20.0)	8 (80.0)	0 (0)	0 (0)	4 (4-4)		
The simulation course improves the learner EKG interpretation skills	Student	60 (67.4)	26 (29.2)	3 (3.4)	0 (0)	5 (4-5)	1.382	0.167
	Teacher	5 (50.0)	3 (30.0)	2 (20.0)	0 (0)	4.5 (4-5)		
The simulation course improves the learner ACLS management skills	Student	66 (74.2)	23 (25.8)	0 (0)	0 (0)	5 (4-5)	0.282	0.778
	Teacher	7 (70.0)	3 (30.0)	0 (0)	0 (0)	5 (4-5)		
The high-fidelity mannequin is realistic	Student	55 (61.8)	32 (36.0)	2 (2.2)	0 (0)	5 (4-5)	2.838	0.005*
	Teacher	2 (20.0)	6 (60.0)	2 (20.0)	0 (0)	4 (4-4)		
The learner enjoys simulation-based learning	Student	56 (62.9)	32 (36.0)	1 (1.1)	0 (0)	5 (4-5)	1.947	0.052
	Teacher	3 (30.0)	7 (70.0)	0 (0)	0 (0)	4 (4-5)		
The use of simulation increased the learner motivation to learn	Student	61 (68.5)	26 (29.2)	2 (2.2)	0 (0)	5 (4-5)	2.295	0.022*
	Teacher	3 (30.0)	7 (70.0)	0 (0)	0 (0)	4 (4-5)		
Using simulation increased the learner interest in learning the subject.	Student	62 (69.7)	27 (30.3)	0 (0)	0 (0)	5 (4-5)	1.254	0.210
	Teacher	5 (50.0)	5 (50.0)	0 (0)	0 (0)	4.5 (4-5)		

Simulation-based learning should be incorporated into the curriculum	Student	63 (70.8)	26 (29.2)	0 (0)	0 (0)	5 (4-5)	2.326	0.020*
	Teacher	4 (40.0)	4 (40.0)	1 (10.0)	1 (10.0)	4 (4-5)		
Overall perception Likert score (Median (IQR))	Student	4.93 (4.43-5.00)					2.314	0.021*
	Teacher	4.32 (4.00-4.57)						

5: Strongly agree, 4: Agree, 3: Mediocre, 2: Disagree, 1: Strongly disagree (No response from the participants), ACLS: advanced cardiac life support, EKG: electrocardiogram, SBL: simulation-based learning, * $p < 0.05$

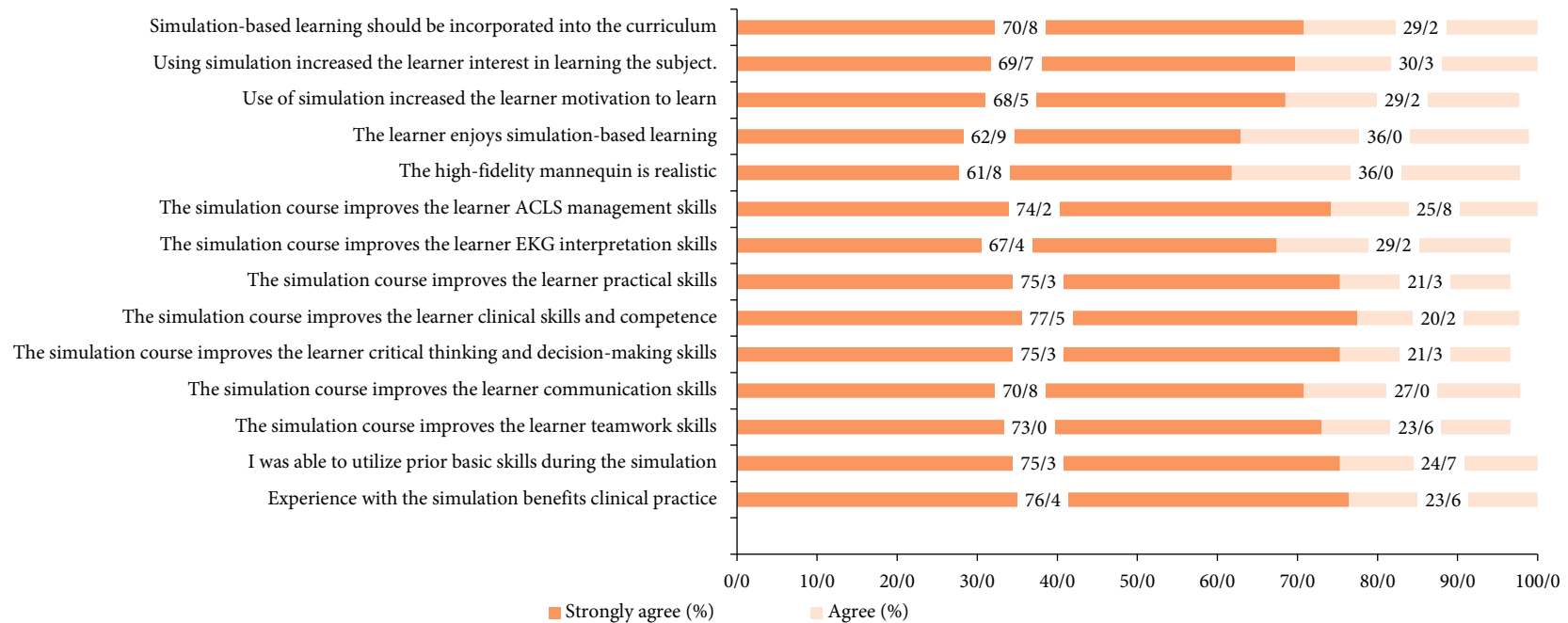


Figure 2. Student perception toward simulation-based learning course

Appendix 1. STROBE Statement-Checklist of items that should be included in reports of cross-sectional studies

	Item No	Recommendation	Extension for SBR	Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	In abstract or key terms, the MESH or searchable keyword term must have the word "simulation" or "simulated."	2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found		1
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Clarify whether simulation is subject of research or investigational method for research.	3-5
Objectives	3	State specific objectives, including any prespecified hypotheses		4-5
Methods				
Study design	4	Present key elements of study design early in the paper		5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection		5-6, 8-9
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants		5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Describe the theoretical and/or conceptual rationale for the design of the intervention/exposure. Describe the intervention/exposure with sufficient detail to permit replication. Clearly describe all simulation-specific exposures, potential confounders, and effect modifiers.	5-7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	<i>In describing the details of methods of assessment, include (when applicable) the setting, instrument, simulator type, timing in relation to the intervention, along with any methods used to enhance the quality of measurements. Provide evidence to support the validity and reliability of assessment tools in this context (if available).</i>	5-9
Bias	9	Describe any efforts to address potential sources of bias		
Study size	10	Explain how the study size was arrived at		5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why		6,8,9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	Clearly indicate the unit of analysis (e.g., individual, team, system), identify repeated measures on subjects, and describe how these issues were addressed.	6,7,9

		(b) Describe any methods used to examine subgroups and interactions		N/A
		(c) Explain how missing data were addressed		N/A
		(d) If applicable, describe analytical methods taking account of sampling strategy		N/A
		(e) Describe any sensitivity analyses		N/A
	Item No	Recommendation	Extension for SBR	Page No
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study-e.g., numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed		10
		(b) Give reasons for non-participation at each stage		N/A
		(c) Consider use of a flow diagram		N/A
Descriptive data	14*	(a) Give characteristics of study participants (e.g., demographic, clinical, social) and information on exposures and potential confounders	In describing characteristics of study participants, include their previous experience with simulation and other relevant features as related to the intervention(s)	10
		(b) Indicate number of participants with missing data for each variable of interest		N/A
Outcome data	15*	Report numbers of outcome events or summary measures		N/A
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included	For assessments involving >1 rater, interrater reliability should be reported.	N/A
		(b) Report category boundaries when continuous variables were categorized		11-15
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period		N/A
Other analyses	17	Report other analyses done- e.g., analyses of subgroups and interactions, and sensitivity analyses		N/A
Discussion				
Key results	18	Summarise key results with reference to study objectives		17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Specifically discuss the limitations of SBR.	20
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence		17-20

Generalisability	21	Discuss the generalisability (external validity) of the study results	Describe generalizability of simulation-based outcomes to patient-based outcomes (if applicable).	19-20
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	List simulator brand and if conflict of interest for intellectual property exists.	N/A

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

The extension of the Simulation-based report is adapted from the following:



Cheng, A., Kessler, D., Mackinnon, R. et al. Reporting guidelines for health care simulation research: extensions to the CONSORT and STROBE statements. *Adv Simul* 1, 25 (2016). <https://doi.org/10.1186/s41077-016-0025-y>

Appendix 2. Content validity by Item-objective congruence method

Questions	Expert 1	Expert 2	Expert 3	Total score	Average score	Result	Suggestions before amendment
The integration of basic EKG interpretation into ACLS stations through the SBL course could improve these learning outcomes	1	1	0	2	0.67	Revision	It could be more concise and be in an active voice
EKG interpretation skills	1	1	1	3	1	Accept	
ACLS management skills	1	1	1	3	1	Accept	
Drug selection based on pharmacokinetics and pharmacodynamics	1	0	1	2	0.67	Revision	Should specify "drug selection" such as by pharmacokinetics and pharmacodynamics
Holistic care of a patient	1	1	1	3	1	Accept	
Satisfaction of the self-directed learning resources and the allocated time	1	1	0	2	0.67	Revision	It should also include the allocated time
Sample videos/medical team for pre-learning purposes	1	1	1	3	1	Accept	
Common EKG examples	1	1	1	3	1	Accept	
ACLS algorithms for pre-learning purposes	1	1	1	3	1	Accept	
The amount of time for preparation before class is appropriate	0	1	1	2	0.67	Revision	It should be more specific and include "is appropriate" in the clause
Satisfaction with the scenarios and equipment	1	1	1	3	1	Accept	
Number of scenarios	1	1	1	3	1	Accept	
The diversity of the scenarios	1	1	1	3	1	Accept	
The difficulty of the scenarios	1	1	1	3	1	Accept	
The duration of each scenario	1	1	1	3	1	Accept	
Satisfaction with the equipment	1	1	1	3	1	Accept	
Number of equipments	1	1	1	3	1	Accept	
The equipment is realistic	1	1	1	3	1	Accept	

The level of difficulty in handling the high-fidelity mannequin is appropriate	0	1	1	2	0.67	Revision	It should be more specific and include "is appropriate" in the clause
Teaching and learning manual	1	1	1	3	1	Accept	
Perception toward the SBL course							
Experience with the simulation benefits clinical practice	1	1	1	3	1	Accept	
The learner was able to utilize prior basic skills during the simulation	1	1	1	3	1	Accept	
The simulation course improves the learner teamwork skills	1	1	1	3	1	Accept	
The simulation course improves the learner communication skills	1	1	1	3	1	Accept	
The simulation course improves the learner critical thinking and decision-making skills	1	1	1	3	1	Accept	
The simulation course improves the learner clinical skills and competence	1	1	1	3	1	Accept	
The simulation course improves the learner practical skills	1	1	1	3	1	Accept	
The simulation course improves the learner EKG interpretation skills	1	1	1	3	1	Accept	
The simulation course improves the learner ACLS management skills	1	1	1	3	1	Accept	
The high-fidelity mannequin is realistic	1	1	1	3	1	Accept	
The learner enjoys simulation-based learning	1	1	1	3	1	Accept	
The use of simulation increased the learner motivation to learn	1	1	1	3	1	Accept	
Using simulation increased the learner interest in learning the subject.	1	1	0	2	0.67	Revision	It could be more concise and be in an active voice
Simulation-based learning should be incorporated into the curriculum	1	1	0	2	0.67	Revision	Be more specific. Such as should be "incorporated into the curriculum".

Students Engagement in One Health Initiatives in Africa: Recommendations to a Way Forward

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Abstract

Background: One Health is a multisectoral, collaborative, and interdisciplinary strategy that involves humans, animals, and environmental health.

Objectives: This study aims to examine the current involvement of medical and veterinary students in One Health initiatives and provide recommendations on challenges students face when participating in One Health programs.

Methods: We utilized our personal experience as medical and veterinary students and data from online scientific databases such as PubMed, Google Scholar, and African Journals Online (AJOL).

Results: One Health issues, such as COVID-19, Monkeypox, Ebola, Avian influenza, antimicrobial resistance, etc., continue to threaten the public health of Africans, which makes the involvement of students pertinent to contribute to the maximum enhancement of One Health awareness in the continent. In Africa, a limited number of medical and veterinary students are involved in the One Health initiatives and practices because of their limited knowledge about One Health. Also, many students face personal, social, and governmental challenges while participating in the program.

Conclusion: To increase the awareness of medical and veterinary students about One Health in Africa, the importance of One Health should be drawn from all the interdisciplinary courses offered by medical and veterinary students. The government should support One Health initiative programs among students, and interprofessional activities should be created among medical and veterinary students. This will inform the students of their role in eradicating One Health issues in Africa.

Keywords: One Health, Interdisciplinary Communication, Student Engagement, Africa

Background

One Health approach is a synergistic strategy that recognizes the health interdependency between people, animals, and their shared environment (1). This approach recognizes the strong relationship between these elements and their need to address health issues through interrelated perspectives (1).

Due to many anthropogenic drivers and changing disease patterns, there has been a sporadic increase in emerging pandemics globally. Adaptation and changes in microbes, climate and weather, human demography and behavior, poverty, and other factors are some causes of this increase, particularly in Africa (2). African

nations have experienced many disease outbreaks, including Severe Acute Respiratory Syndrome, Usutu virus disease, Anthrax, Polio disease, West Nile virus disease, Ebola, Monkeypox, etc., which have demonstrated that not only do we need essential education in improving epidemic preparedness but also a One Health approach that leverages the expertise of interdisciplinary set of professionals to potentiate responses to global health issues (3-11).

Despite an urgent need for a change in health approach to a more interdisciplinary One Health fashion, healthcare professionals require more awareness to facilitate such a transition (12). There is no

doubt that medical and veterinary students are prospective healthcare professionals who will carry on the mandate of collaboratively addressing global health concerns. However, there has been limited knowledge about the One Health approach among African students, especially medical students (13). This makes the implementation of the One Health approach challenging to some practitioners during practice.

Objectives

This study aims to examine the current involvement of medical and veterinary students in One Health initiatives and provide recommendations on the challenges students face when participating in One Health programs.

Methods

We utilized our personal experience as medical and veterinary students, supported by literature from scientific databases such as PubMed, Google Scholar, and African Journals Online (AJOL) in writing this paper. The databases were searched using the keywords: “Medical”, “Medicine”, “Veterinary”, “Veterinary Medicine”, “University”, “College”, “Students”, “One Health”, “One Health Initiatives”, “One Health Programs”, “One Health issues”, and “Africa”. Only articles published in English were included in the study. Articles published in other languages were excluded. Our focus was Africa; articles published outside Africa were excluded from the study.

Medical and Veterinary Students in Africa

Human and veterinary medicine are mainstream

programs that provide solutions to public health issues in Africa. This has resulted in a higher number of medical and veterinary schools in Africa. The International Association of Universities, the World Higher Education, and the American Veterinary Medical Association database 2022 list about 447 medical schools and 54 veterinary medicine schools in Africa (Figure 1). These are distributed across the northern, eastern, southern, central, and western regions of Africa. East Africa has the highest number of medical schools, with approximately 171, representing 38.3% of the total number of medical schools in Africa. West Africa followed closely with 119 medical schools, representing 26.6% of the total medical schools; North, Central, and Southern Africa after that had 71, 64, and 22 medical schools, representing 15.9%, 14.3%, and 2.9% of African medical schools, respectively. It is also worth mentioning that the country with the highest number of medical schools is Nigeria, a country in the western region of Africa. Leading their respective regions are Sudan, Egypt, the Democratic Republic of Congo, and South Africa, with 47, 30, 38, and 17 medical schools, respectively (Table 1) (14).

Current Experience of One Health in Medical Schools

One Health is not a commonly discussed topic in African medical schools. A study by Terrigbade and Babalobi found that 31.7% of medical students have a detailed knowledge of One Health, 23.3% of medical students were eager to learn more about One Health, and generally had an averagely good attitude towards the One Health concept (13).

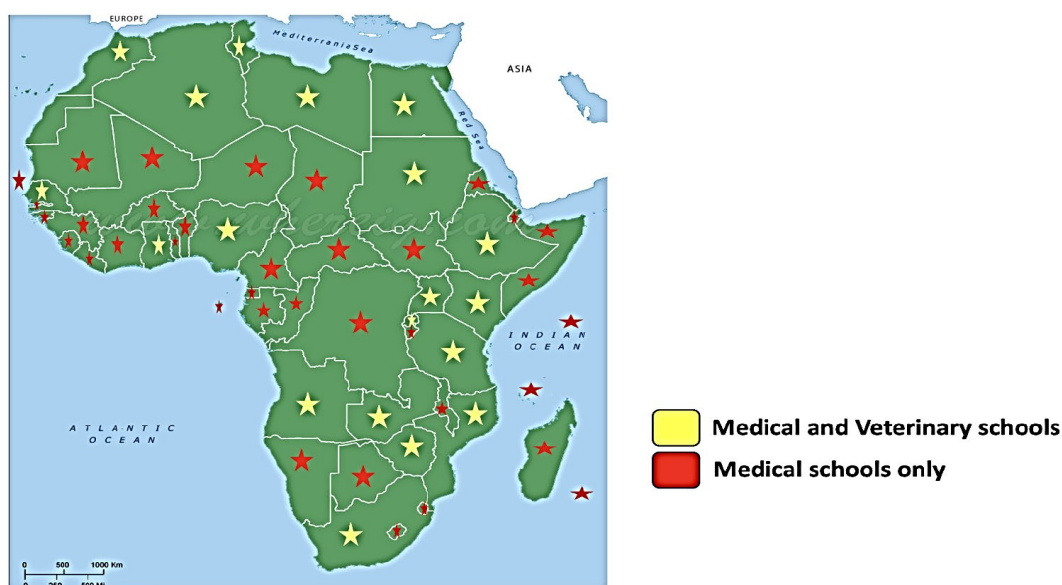


Figure 1. A map illustrating the distribution of veterinary schools in Africa

Table 1. List of medical and veterinary schools in Africa (14, 15).

Country	Region	Number of medical schools	Number of veterinary schools
Algeria	Northern Africa	17	6
Angola	Central Africa	10	1
Benin	Western Africa	2	Nil
Botswana	Southern Africa	2	Nil
Burkina Faso	Western Africa	6	Nil
Burundi	Eastern Africa	6	Nil
Cameroon	Central Africa	8	Nil
Cape Verde	Western Africa	2	Nil
Central African Republic	Central Africa	1	Nil
Chad	Central Africa	1	Nil
Comoros	Eastern Africa	1	Nil
Democratic Republic of the Congo	Central Africa	38	Nil
Djibouti	Eastern Africa	1	Nil
Egypt	Northern Africa	30	13
Equatorial Guinea	Central Africa	1	Nil
Eritrea	Eastern Africa	2	Nil
Eswatini	Southern Africa	1	Nil
Ethiopia	Eastern Africa	26	5
Gabon	Central Africa	3	Nil
Ghana	Western Africa	7	1
Guinea	Western Africa	8	Nil
Guinea-Bissau	Western Africa	2	Nil
Ivory Coast	Western Africa	5	Nil
Kenya	Eastern Africa	17	1
Lesotho	Southern Africa	1	Nil
Liberia	Western Africa	2	Nil
Libya	Northern Africa	9	2
Madagascar	Eastern Africa	6	Nil
Malawi	Eastern Africa	5	Nil
Mali	Western Africa	2	Nil
Mauritania	Western Africa	1	Nil
Mauritius	Eastern Africa	10	Nil
Morocco	Northern Africa	9	1
Mozambique	Eastern Africa	9	1
Namibia	Southern Africa	1	Nil
Niger	Western Africa	3	Nil
Nigeria	Western Africa	49	10
Republic of the Congo	Central Africa	1	Nil
Rwanda	Eastern Africa	2	1
Sao Tome and Principe	Central Africa	1	Nil
Senegal	Western Africa	7	1
Seychelles	Eastern Africa	1	Nil
Sierra Leone	Western Africa	21	Nil
Somalia	Eastern Africa	1	Nil
Somaliland	Eastern Africa	1	Nil
South Africa	Southern Africa	17	2
South Sudan	Eastern Africa	3	Nil
Sudan	Eastern Africa	47	3
Tanzania	Eastern Africa	9	1
The Gambia	Western Africa	1	Nil
Togo	Western Africa	1	Nil
Tunisia	Northern Africa	6	1
Uganda	Eastern Africa	11	1
Zambia	Eastern Africa	10	1
Zimbabwe	Eastern Africa	3	1

In another survey carried out by Yanney, only 5.8% of students were found to have heard of One Health. A great majority indicated an interest in learning more about One Health topics and believed that understanding the topics would be helpful for their future careers (16). Furthermore, it was said that because of the college's innately collaborative and interdisciplinary atmosphere, undergraduate education is the perfect setting for introducing One Health to students (16).

The first exposure of medical students to "One Health" at the College of Medicine, University of Ibadan, Nigeria, is in the fifth of the six years of the medical program. This curriculum might have contributed to the limited knowledge of medical students in Nigeria about One Health because they were not exposed to One Health principles earlier, and their participation in One Health Programs will be equally affected during their studies and after.

Pre-service capacity development efforts have been implemented at Makerere University in Uganda to foster One Health competencies among students who would become practitioners (10). Student One Health Innovation Clubs, undergraduate field experiences at demonstration sites, graduate fellowships, small grants to support research and innovations, and cross-college collaborative training approaches have helped integrate One Health into the fabric of university offerings and incorporate it into didactic education systems. Partnerships with government departments, the commercial sector, and foreign organizations were launched to benefit the students and pave the way for future experiential learning and in-service opportunities (17).

To promote One Health concepts in eight Eastern, Central, and West African countries, a network of human medicine, public health, and veterinary medicine institutions known as One Health Central and Eastern Africa (OHCEA) was established (18, 19). In Uganda, Interested medical students of different levels from Makerere University join the Makerere University Students One Health Initiative Club (MAKSOHIC), which proffers early exposure and enables participants to gain expertise and competency in One Health leadership, research, innovation, and scientific communication via creative intellectual discussion and participation around identified One Health concerns. Many international universities in the developed world have also adopted the idea of engaging medical students in the community medicine rotation in their fourth year of study (20, 21).

Even though the level of exposure varies amongst the different medical schools, just about little or none of them deemed it fit to pursue research interest in this One Health field. Public opinions and collaborations with fellow enablers of the One Health approach or any intervention were not found. The scarcity of literature on the awareness or impact of the One Health approach in medical schools supports our assertion. This revealed that African medical students are averagely aware of One Health. Amongst those aware, an almost insignificant percentage of them are not involved in research related to One Health.

Current Experience of One Health in Veterinary Medical Schools

Veterinarians are significant stakeholders in the stewardship of One Health, and they provide versatile training directly or indirectly applicable to the health of animals, humans, and wildlife. Therefore, proper education of veterinary students during their training on One Health will be a fundamental approach to promoting the One Health landscape in Africa. However, only a few countries in the continent have recognized veterinary medical schools (Table 1). Egypt, Nigeria, Sudan, and Algeria have the highest numbers, while others have fewer veterinary schools. This data suggests the need to establish more veterinary schools in the African region as this will increase the number of professionals with skills to tackle One Health issues in Africa.

Studies have been conducted to assess students' knowledge of One Health and related issues in some veterinary schools in Africa (11, 12). It has been shown that veterinary students need a better perception of knowledge on antimicrobial resistance and stewardship and that knowledge of One Health and related issues like antimicrobial resistance (AMR) is more prevalent among final-year veterinary students compared to pre-final year veterinary students (22).

One Health Programs Available for Students in Africa

Efforts have been made to improve the training of potential One Health professionals in Africa, prominent among which is the One Health Central and Eastern Africa (OHCEA), now Africa One Health University Network (AFROHUN). The OHCEA is a network of 19 institutions across 10 countries in Africa aimed towards improving One Health capacity in region (23).

Some institutions within the OHCEA network have One Health field attachments consisting of a multidisciplinary group of students, including veterinary students, who live and work together in the community (18). Such initiative has enabled the

involved students to appreciate teamwork, community development, use of available resources through innovative means, and benefit communities (24). Also, many institutions within the OHCEA promote the formation of One Health clubs (24). One Health clubs provide students a medium to discuss and integrate One Health concepts practically (25). While these developments show promise in helping to drive forward One Health's involvement of medical veterinary students in Africa, upscaling the implementation of such initiatives across other regions and countries within the region will potentiate its benefits. Such implementation should also involve low- and high-level students to ensure their increasing knowledge and practical involvement in One Health programs through available platforms earlier.

Issues and Challenges

Lessons from the outbreak of zoonotic infectious diseases in Africa have further highlighted the importance of One Health in the region (26, 27). To this end, a collaboration of various fields of health involving an enlarged body has been working to improve the health situation in Africa (27). The exact concept of one health (18). However, these collaborations exist only at the top and professional levels. Little initiatives about One Health Research have been found among African medical and veterinary medical students, primarily due to the challenges that limit its fostering among these populations.

Limited One Health student clubs: One Health has been widely endorsed and encouraged in Africa, and several large One Health initiatives currently encompass an array of universities in Africa (28). However, only one of these initiatives (One Health Central and Eastern Africa (OHCEA)) is notably recognized for forming One Health Student clubs (18). The absence of One Health student clubs among students limits students' exposure and knowledge about One Health, reducing their chances of stimulating their interest in One Health programs.

Lack of inter-professional learning: Apart from the limited One Health student clubs challenge, medical and veterinary students are rarely given opportunities for inter-professional learning as part of their coursework and clinical training; in many African institutions, medical and veterinary medical schools are not in the exact location (28). This difference in the learning environment's locations and the few opportunities for inter-professional learning among medical and veterinary students stifle potential interactions between

these students, limiting their collaboration to foster One Health Initiatives.

Difficulties of long-distance collaboration: Notwithstanding the distance between medical and veterinary students, the practice of One Health is still possible under these conditions. The utilization of Internet and social network services allows for long-distance collaborations; however, the difficulty associated with this method in terms of the cost of purchasing data, power supply problems, scheduling convenient times for each other, and so on does not encourage students' interest in utilizing it. In addition to the convenience issues concerning organizing opportunities for collaboration between medical and veterinary medical students, the considerable academic workload and accompanying stress among these students do not help the situation. Several studies have reported high burnout among African medical and veterinary medical students (29, 30). Under these conditions, adding more commitments like engaging in collaborations for One Health will be difficult for these students. It may also explain the low involvement of African medical students in One Health programs.

Little interest of students in One Health Programs: Another barrier to students' participation in One Health initiatives is the medical research disadvantage in most African institutions. According to research conducted in Saudi Arabia, most students face issues such as a lack of funding and required skills, limited access to professional supervisors or mentors, limited or no access to database subscriptions, and inadequate laboratories and equipment (31, 32). These factors, combined with African institutions' little emphasis on research as part of their curriculum, have resulted in the current situation in which African medical students generally have little interest in research, which invariably significantly impacts their participation in One Health initiatives (33).

Limited knowledge of One Health concept: An ideological barrier exists because the structure of One Health can be unclear to many potential stakeholders. Many medical students are unaware of the scope of One Health because of the limited exposure to cases or classes during their training. A previous study done by Terrigbade and Babalobi showed that 31.7% of medical students at the University of Ibadan, Nigeria, have an idea of the One Health concept (13). Compared to veterinary students, which make up 65% of the population, medical students need more involvement in One Health initiatives.

Recommendations: We recommend several proposals to strengthen medical and veterinary students' involvement in One Health initiatives.

Establishment of One Health student clubs: To increase the African medical and veterinary students' exposure to the One Health approach, the available regional One Health initiatives, such as the One Health Central and Eastern Africa (OHCEA), should set up more One Health student clubs. The One Health clubs would serve as student communities of One Health enthusiasts. It would also provide an enlightenment avenue and discussion platform to help incite students' interest and ultimately kindle up the one health research culture (17).

Revisiting the curriculum of medical students to include the One Health concept: The knowledge of medical students about One Health could be higher than veterinary students, which might be linked to limited courses on One Health. The curriculum of medical students should be revisited to include a significant amount of the One Health concept. This will help increase medical students' awareness about One Health and make them curious to be involved in One Health initiatives. The only course in which medical students are exposed to One Health is 'Community Medicine,' which is minimal compared to veterinary medicine courses that teach veterinary students about One Health. Every aspect of medical courses should be related to animals and environments (One Health). It will help the students to know the importance of One Health.

Increasing funds for One Health student clubs: Funding should be available to support the students involved in One Health initiatives. Students must engage in One Health align projects for the community to reduce the One Health emerging issues in Africa. To do this, they need limited funds to organize themselves in order Africa. We shout out to the World Health Organization, National Institute of Health, and other health organizations to support the ideas of the young students willing to contribute to One Health issues like COVID, Ebola, Lassa fever, etc., in Africa.

Increasing One Health mentorship programs for students: Mentorship is important in an organization that involves young people to guide them to success because they lack the required skills. One Health Practitioners should make it compulsory for them to guide student Organizations built to promote One Health. The issue of mentorship is something that is lacking in Africa and limits young students' ability to get involved in things to promote themselves.

Conclusion

One Health is a multisectoral, collaborative, and transdisciplinary strategy to obtain optimal health outputs while acknowledging the interdependence between humans, animals, plants, and their shared environment. Reinforcing the involvement of African medical and veterinary students in One Health initiatives is crucial. It will benefit the students and the health and research community in Africa. As One Health public challenges are increasing daily in Africa, students will develop the sense to tackle them from school and help promote One Health programs. Recommendations provided in this article include the establishment of One Health student clubs, revisiting the curriculum of medical students to include the One Health concept, increasing funds for One Health student clubs, and increasing One Health mentorship programs for students are essential in battling the challenges faced by students.

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