

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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