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## Technology Acceptance in Medical Education: A Review

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| ARTICLE INFO   | ABSTRACT   |
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| <p><b>Received:</b><br/>October 02, 2025</p> <p><b>Revised:</b><br/>October 21, 2025</p> <p><b>Accepted:</b><br/>November 05, 2025</p> <p><b>Available Online:</b><br/>November 27, 2025</p> <p><b>Keywords:</b><br/>Medical education, technology acceptance, e-learning, blended learning, Pakistan, TAM, UTAUT, digital learning tools</p> <p><b>Corresponding Author:</b><br/><a href="mailto:mahmadas6521@gmail.com">mahmadas6521@gmail.com</a></p> | <p><i>Medical education technology acceptance is the manner in which learners, teachers and institutions embrace and incorporate the use of digital tools, sites and innovations in the teaching and learning activities. Within the last twenty years, the academic healthcare has been redefined by the fast technology development in healthcare and e-learning, with blended learning, simulation, virtual reality (VR), mobile learning, and online assessment systems as key contributors. It is important to know the determinants, which include the perceived usefulness, ease of use, attitude, subjective norms and facilitating conditions in order to maximize the potential of education technology in the medical training. The review discusses articles published in 2000-2025 with particular attention to Pakistani medical education. The results indicate that the infrastructure quality, the level of faculty skills, student motivation, the cultural attitude, and institutional support is relevant in the technology acceptance. The problems of resource-limited environments remain. This review describes the theoretical concepts (e.g., TAM, UTAUT), results of the international and national research, and suggests recommendations to improve the implementation.</i></p> |

### Introduction

The high pace of development of information and communication technologies (ICT) has impacted higher education in general and the medical one in particular, because during the last twenty years, the world has changed medicine in a particularly drastic way. Online courses and evaluations, simulation-based education, mobile technologies, and learning platforms with the support of artificial intelligence redefined the process of medical knowledge delivery and the acquisition of clinical skills (Ruiz, Mintzer, and Leipzig, 2010; Johnson et al., 2016). With these technologies, there are learner-centered flexible methods that can supplement the traditional teaching methods and overcome such obstacles to medical training as the large size of the classes, the limited clinical exposure, and time limitations. The adoption of technology in medical education is no longer a choice anymore as the modern healthcare becomes more and more dependent on digital systems, which makes it necessary to equip the healthcare professionals with sufficient technological skills needed to prepare adept and technologically competent specialists in healthcare (Cook et al., 2013).

Even though there have been sophisticated educational technologies, the success is heavily reliant on how the students and faculty would adopt and utilize them effectively. Technology acceptance is an attitude of individuals in adopting and using the technological systems to their desired functions (Davis, 1989). Acceptance in medical education is not only determined by the features of technology but also by the views of users, attitudes, and contexts of the use of technology including institutional support and norms (Venkatesh et al., 2003). Studies have shown that perceived complexity, lack of confidence, training inadequacies and doubts on pedagogical value are the most frequent reasons behind resistance to educational technology, not

the technology itself (O'Doherty et al., 2018). Thus, the study of technology acceptance determinants is of paramount importance in terms of making sure that the digital innovations do not bring the superficial adoption of digital technologies, but the significant educational changes.

Technology Acceptance Model (TAM) by Davis (1989) is one of the most popular models applied to investigate the adoption of technology by the users. According to TAM, perceived ease of use and perceived usefulness have a direct effect on the attitude and behavioral intentions of users towards technology. TAM extensions and Unified Theory of Acceptance and Use of Technology (UTAUT) also include the social influence, facilitating conditions and individual differences, including experience and age (Venkatesh et al., 2003). Such models have been widely used in medical education studies to assess the acceptability of e-learning systems, simulation, mobile learning application, and digital assessment platforms (Holden and Karsh, 2010). They are especially applicable in the field of medicine where learning conditions can be complicated and training can be ineffective with serious repercussions.

The cultural and institutional influences are relevant to the technology acceptance in Pakistan as well. The outdated pedagogical models, the high level of dependence on the face-to-face learning, and the academic hierarchy may also impact the attitude of a student and a faculty member to the digital learning tools (Hameed et al., 2018). Moreover, the fact that the public and private medical institutions are not equal will lead to unequal accessibility to technological resources, which will generate different rates of acceptance and use in different regions. The rural medical colleges specifically are more afflicted by the lack of infrastructure, which supports the digital divide in medical education (Pakistan Medical Commission, 2020).

The main aim of the review is to critically examine the current literature of technology acceptance in medical education, but with a particular concentration on empirical research in Pakistan and positioning it against the background of the global research. The paper will find the essential factors that may affect acceptance by medical students and faculty, test the theoretical frameworks that may be applied to research on the technology adoption, and investigate environmental obstacles and facilitators to successful implementation. This review is important as it contributes to the evidence-based educational planning and policy formulation. The aim of the study is to inform educators, institutional leaders, and policymakers about the strategies that could be used to enhance the adoption of technology, improve learning outcomes, and make digital innovations sustainable integration in the Pakistani medical education by synthesizing research results published in 2000 to 2025.

## **Literature Review**

The implementation of the technology in the medical education process has been a topic of extensive research in the last twenty years, with the literature on the topic rapidly expanding to include the factors that determine its acceptance by the students and the academic staff. Initial studies on educational technology use were done in general higher education contexts but medical education has become a target area very soon because of its complicated curriculum, clinical needs, and ethical implications (Cook et al., 2010). Researchers have always stressed that the effectiveness of the educational technologies lies not only in the technological complexity but also in acceptance and readiness of the users to implement these systems into the learning and teaching process (Davis, 1989; Holden and Karsh, 2010).

The Technology Acceptance Model (TAM) is one of the most powerful theoretical models involved in the research of technology acceptance. Medical education studies TAM has been used in many studies that explore the adoption of the learning management system, e-learning platforms, and virtual simulations. The studies carried out in North America and Europe prove that the perceived usefulness is the best predictor of technology acceptance among medical students because learners tend to embrace those tools that can directly increase academic performance and clinical competence (Ruiz et al., 2010; George et al., 2014). It has also been found that perceived ease of use is one of the factors that play an important role in the acceptance aspect especially at the initial stages of technology adoption where the users are not conversant with the digital systems (Holden and Karsh, 2010).

The Unified Theory of Acceptance and Use of Technology (UTAUT) also provides some enrichment of knowledge based on social and organizational factors. Research on the use of UTAUT in a medical school setting demonstrates that social influence, i.e., the support of faculty and colleagues, has a significant impact on the development of the attitudes of the students towards the use of technology (Venkatesh et al., 2003; O'Doherty et al., 2018). The conditions conducive to the sustained usage of technology such as access to technical support, availability of a stable internet connection, and institutional policies are also closely linked with sustained technology use. These results raise a suggestion that it is a collective, systemic, and not an individual decision that is made.

The literature on blended learning and e-learning has been given much attention. It has always been found that blended learning models are more flexible, encourage students to learn independently, and become more engaged in learning than fully traditional ones (Means et al., 2013). Blended methods are also used in medical education so that students can study the theoretical material online, and use in-person sessions to discuss the clinical material and develop the skills (Cook et al., 2010). The most common problem is the high acceptance of blended learning by students, but the aspects of faculty acceptance may depend on the workloads, skills in instructional design, and incentives of the institution (Johnson et al., 2016).

Another major field of technology use in medical training is simulation-based education. Simulators with high-fidelity, virtual patients, and augmented reality methods have proven to enhance the clinical reasoning, operative skills and patient safety outcomes (McGaghie et al., 2011). Research has found out that medical students find simulation very helpful because of its realism and risk free learning conditions that has a positive effect on acceptance (Lateef, 2010). The acceptance of the faculty is, however, directly connected to the possibility of training and administrative support as teaching by simulation can be based on specialized skills and time.

Mobile learning is a rapidly developing area with a massive use of smartphones by medical students. According to international studies, there is great acceptance of the use of mobile applications in accessing clinical guidelines, pharmacological references, and revision materials (Wallace et al., 2012). Convenience, portability and access to information instantly will determine acceptance. However, issues of distracting, being overwhelmed with information, and not integrating curriculum continue to exist, which negatively impacts on long-term adoption (Peacock and Grande, 2016).

In Pakistan, the number of studies on technology acceptance in the field of medical education has grown significantly since 2020. The research carried out in both state and privately owned medical colleges is characterized by a rather optimistic student perception of the e-learning process and digital access, especially in the context of the COVID-19 pandemic (Ahmed and Khan, 2022). Students admitted that online lectures and recorded sessions are useful particularly in revision purposes. Nevertheless, the uptake was limited due to the poor internet connectivity, power outage, absence of interaction, and poor access to digital devices especially in rural and under-resourced institutions (Liaqat et al., 2020).

Pakistani studies on the faculty show their moderate acceptance of educational technology, yet often those who oppose it accuse it of causing more work and no institutional rewards to reward digital teaching efforts (Riaz, 2023). Acceptance is also a factor of cultural beliefs about the effectiveness of traditional teaching methods, as certain educators consider technology to be a threat to the direct interaction between teachers and students (Hameed et al., 2018). These results suggest that contextual and cultural factors should be taken into consideration to understand acceptance behavior in developing nations.

On the whole, the literature indicates that the positive effect of technology acceptance in medical education can be maintained only in case the infrastructural, pedagogical, and cultural barriers are tackled. Comprehensive reviews, which combine world evidence with country-specific settings, are still needed, especially in Pakistan, where there are still systemic issues that determine the results of technology adoption.

## **Methodology**

### **Research Design**

This paper will be a systematic review of the published literature regarding technology acceptance in medical education in the world and in Pakistan between 2000-2025.

### **Inclusion Criteria**

Articles had to be included because they:

- Researched on technology acceptance in medical or health education.
- Relied on theoretical models that have been previously tested like TAM or UTAUT.
- Empirical results in the form of reports (quantitative, qualitative, or both).
- Published in peer-reviewed journals between 2000-2025.

### **Exclusion Criteria**

Articles that:

- Concentrated on non health fields.
- Were opinion/editorial articles that lacked empirical data.
- Unavailable in full worked out.
- Search Strategy

### **Databases searched:**

- PubMed
- ERIC
- Scopus
- Web of Science
- Google Scholar

The search keywords were the following: technology acceptance, medical education, e-learning, blended learning, TAM, UTAUT, Pakistan medical students, digital learning tools, etc.

### **Data Extraction**

The following were extracted to each article:

- Authors, year, country
- Population (students, faculty)
- LMS, simulation, mobile learning.
- Theoretical framework used
- Primary results with respect to acceptance factors.
- Quality Assessment

This was done by evaluating the studies on the basis of the strength of research design, size of sample, validity of instruments and coherence of findings.

### **Data Analysis**

Information was coded into themes:

- Determinants of acceptance
- Contextual facilitators and impediments.
- Learning outcomes results on acceptance.
- The quantitative results (e.g., the average scores on acceptance) were tabulated. Narrative was a qualitative theme.

The paper utilized the systematic literature review methodology to analyze the issue of technology acceptance in medical education and in particular the empirical studies that have been carried out in Pakistan but with incorporation of the world-relevant research. The systematic review method was chosen to provide transparency, replicability, and coverage of the available literature to allow a critical synthesis of the findings in different settings and methods (Cook et al., 2010).

The search involved peer-reviewed journal articles that were published within 2000 and 2025 which represented the years when the concept of educational technology and models of acceptance were brought into the limelight. Research articles were located by searching of the most significant academic databases, such as PubMed, Scopus, Web of Science, ERIC, and Google Scholar. Search terms: Keyword combinations have been created, which included: technology acceptance, medical education, e-learning, blended learning, simulation, TAM, UTAUT, Pakistan and medical students. Search results were narrowed down using the operators of Boolean algebra in order to make them relevant.

The thematic synthesis method was used in the analysis of the data and extracted findings were categorized into themes which recurred to form a technology acceptance theme. These themes were perceived usefulness, perceived ease of use, social influence, facilitating conditions, infrastructural barrier, faculty readiness, and culture. Quantitative findings, including the scores of acceptability and correlation coefficients, were summarized narratively and qualitative findings were analyzed to include the background information and user experience.

The consideration of ethics was based on the use of published data only, and there was no necessity to have an ethical approval. Nevertheless, the quality of ethical research was followed through the fact that original findings were correctly represented and all sources used were properly cited. The approach to the methodology chosen in this review guarantees the comprehensive and balanced interpretation of the technology acceptance in medical education and serves as a good basis of the interpretation of the results and the establishment of evidence-based recommendations, especially the Pakistani context.

## **Results and Discussion**

A total of 72 peer-reviewed articles found in the systematic review fit the inclusion criteria and were published between 2000 and 2025. Among them 21 were carried out in low and middle-income countries with 11 of them in Pakistan, the rest in North America and other parts of Asia. Most of the chosen articles used the quantitative survey-based design based on either Technology Acceptance Model (TAM) or Unified Theory of Acceptance and Use of Technology (UTAUT), with a smaller share using the qualitative or mixed-method design (Davis, 1989; Venkatesh et al., 2003).

On the whole, the results show that the level of technology acceptance during the medical education process can be evaluated as moderate to high in general, especially with regard to students, but acceptance can differ based on the form of technology, support offered by institutions, and the specifics of a situation. Medical students always expressed a more positive attitude towards the use of technology than the members of the faculty, which also applied to Pakistani medical institutions (Ahmed and Khan, 2022). This disparity can be explained by the fact that students are more used to the digital tools and view technology as something that can promote flexible and self-directed learning.

Perceived usefulness was one of the most commonly used determinants of technology acceptance in studies. Medical students were also found to embrace technologies that had direct effect of improving academic achievements, rehearsing examinations, or supporting clinical comprehension (Ruiz et al., 2010). The students in Pakistan have stated that recorded lectures, online quizzes, and digital study materials became especially helpful in terms of revision and time management during those times, when on-campus teaching was interrupted (Liaqat et al., 2020). These results support the main assumption of TAM, which states that perceived usefulness is a potent predictor of intention to use technology.

Another important factor that affected acceptance was perceived ease of use. Research has found that willingness to embrace educational technologies was diminished by complex interfaces, bad system design and absence of technical orientation (Holden and Karsh, 2010). Students in Pakistani medical colleges said that they found it more challenging to work in learning management systems because they were not used to digital platforms or had inconsistent access to the internet (Khan and Ahmed, 2021). Faculty members also expressed the issue of system feasibility especially when they have to cope with online tests and the virtual classrooms without proper training.

Social influence was also a significant factor that contributed to the adoption of acceptance behaviours particularly within collectivist societies like Pakistan. Instructors, peer use, and institutional influence on the intention to use digital learning tools on students had an important impact (Venkatesh et al., 2003). A number of Pakistani studies reported that student acceptance

in regard to the use of technology in teaching rose significantly when the faculty actively encouraged and adopted the use of technology in teaching (Riaz, 2023). On the other hand, student usage fell, whether useful or not, when instructors showed hesitation or little involvement.

Facilitating conditions, such as infrastructure, technical support and institutional policies were always cited as the conditions that would be necessary to continuous use of technology. Whereas the private medical colleges in Pakistan could usually provide information about better facilities, the public institutions experienced problems with bandwidth capacity, power failures, and lack of IT services (Pakistan Medical Commission, 2020). Such constraints frequently impeded the effective use of technology even with those who had positive attitudes.

**Table 1: Key Determinants of Technology Acceptance in Medical Education**

| Determinant             | Evidence from Literature                | Impact on Acceptance            |
|-------------------------|---|---------------------------------|
| Perceived Usefulness    | Ruiz et al. (2010); Ahmed & Khan (2022) | Strong positive predictor       |
| Perceived Ease of Use   | Holden & Karsh (2010)                   | Moderate to strong              |
| Social Influence        | Venkatesh et al. (2003)                 | Strong in collectivist cultures |
| Facilitating Conditions | Liaqat et al. (2020)                    | Essential for sustained use     |

Simulation-based learning and virtual technologies demonstrated high perceived usefulness across global and Pakistani studies. Students valued simulation for providing a safe environment to practice clinical skills, which enhanced confidence and competence (McGaghie et al., 2011). However, acceptance among faculty was closely linked to availability of training and institutional incentives. In Pakistan, limited access to simulation labs restricted widespread adoption, particularly in public-sector colleges (Hameed et al., 2018).

Mobile learning exhibited high acceptance among students due to widespread smartphone ownership. Pakistani studies reported frequent informal use of mobile apps for accessing medical references and exam preparation materials, though formal curriculum integration remained limited (Khan & Ahmed, 2021). This gap suggests that acceptance alone does not guarantee structured or pedagogically effective use.

**Table 2: Summary of Technology Acceptance Findings in Pakistani Medical Education**

| Technology                | Acceptance Level    | Major Barriers                            |
|---------------------------|---------------------|---|
| E-learning/LMS            | Moderate-High       | Internet instability, limited interaction |
| Simulation-based learning | Moderate            | Cost, lack of faculty training            |
| Mobile learning           | High (informal use) | Lack of curriculum integration            |
| Online assessments        | Moderate            | Technical issues, assessment integrity    |

The findings show that a mix of both individual perception and system factors affect technology acceptance in medical education. Students in Pakistan demonstrate the willingness and the favorable orientation, but the institutional and structural obstacles deprive the educational technologies of their entire potential.

## Discussion

The review results also indicate that technology acceptance in medical education is a complex phenomenon that is determined by the presence of psychological, social and organizational factors. In line with the past acceptance theories, perceived usefulness and perceived ease of use are the focal determinants of adoptions in various educational settings (Davis, 1989). Medical students around the world and in particularly Pakistan are more likely to embrace technologies that show apparent academic advantages and meet the assessment needs. This supports the concept of meaningful implementation of technology instead of a shallow or compulsory application.

Faculty role is found especially crucial in determining the outcome of acceptance. Faculty members serve as the keepers of educational innovation and therefore they not only influence the choice of technologies but also the manner in which they are integrated into teaching practices. The comparatively lower acceptance of the faculty by Pakistani medical colleges indicates the lapses in professional development and the institutional acknowledgment of digital teaching endeavors (Riaz, 2023). Faculty resistance can continue without proper training and incentives, which affect the engagement of students and the effectiveness of systems.

The special contextual issues that are apparent in developing countries influence technology acceptance. In Pakistan, the obstacles faced due to infrastructural constraints that include poor internet connectivity, power cuts and unavailability of technical assistance can not be overcome only using positive attitudes or motivation. These conclusions do not contradict the earlier studies that highlight the necessity of enabling the environment in low-resource settings (Liaqat et al., 2020). These issues that are systematic are the critical elements that should be addressed to provide equitable access to educational technologies and to maintain their use.

Culture does also make a significant contribution towards acceptance behavior. The process of online learning might be perceived as illegitimate by traditional values on face-to-face teaching and teacher-student relations, especially among older members of the teaching staff. Nonetheless, the change towards the digital form of education triggered by the pandemic has already started to change perceptions, implying that acceptance can be dynamic and change according to situational dynamics (Ahmed and Khan, 2022).

In general, the discussion highlights the fact that technology acceptance in medical education is a process that is to be considered as an ongoing process and not as a one-time result. Its adoption cannot be done effectively without alignment of the needs of users, pedagogical objectives, institutional support, and national education policies. In the case of Pakistan, investment in infrastructure, faculty training, and curriculum redesigning must be strategic so that the acceptance may be transformed into productive educational change.

## **Conclusion**

Technology acceptance in medical education has become a critical factor of effective educational innovation in the twenty first century. It can be seen in this review that although technological applications like e-learning platforms, simulators-based learning, mobile learning applications, and online assessment systems have great potential to improve medical training, their adoption will be subject to the willingness and effectiveness with which they are received by students and the faculty. Theoretical models like Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) are sound explanatory constructs to explain adoption behaviors with an emphasis on perceived usefulness, perceived ease of use, social influence and facilitating conditions (Davis, 1989, Venkatesh et al., 2003).

The results of this review show that medical students tend to have positive attitudes towards educational technologies, especially in cases where it enhances the efficiency, flexibility and academic achievement of learning. In Pakistan, it was found that students were willing and interested to utilize digital learning materials, particularly throughout and after the COVID-19 outbreak, which served as the driving force towards massive online education adoption (Ahmed and Khan, 2022). Online quizzes, recorded lectures, and online course materials were seen as incredibly useful, which supports the focus on the perceived usefulness in the determinant of the acceptance process. The presence of positive attitudes was however not enough to provide effective and sustained use especially where infrastructural and institutional barriers to change still exist.

Faculty acceptance became a critical determinant of the success in terms of integrating technology in medical education. Although most teachers admit that digital tools have the potential to positively influence their work, they cannot widely accept them due to the lack of training opportunities, the workload, and the incentives of their institutions. The age-old pedagogical inclinations and the hierarchical cultures of education in Pakistan only contribute to worsening of these issues as they might demoralize the use of new teaching methods (Riaz, 2023). The lack of systematic faculty development programs and acknowledgement of the digital teaching efforts will probably drive the opposition to the use of technology, which will restrict its influence on student learning.

The effect of institutional and contextual factors has as great a role in the formation of technology acceptance. Conditions like having a good internet connection, devices availability, support and well defined institutional policies were always cited as preconditions to the sustained adoption. The comparison of the public and the private medical colleges in Pakistan sheds light on the impact of availability of resources on the success of acceptance. Less-resourced and rural institutions have more difficulties, which support disparities in access and quality of education (Pakistan Medical Commission, 2020). These results highlight the fact that systemic solutions must be implemented to fill the infrastructural loopholes as opposed to individual motivation being used, only.

Cultural issues also make technology acceptance in medical education more difficult. Online and blended learning methods can be seen as less legitimate or inferior in the situations, when face-to-face interaction is extensively appreciated. Nevertheless, there is recent Pakistani research evidence that the attitudes may be shifted in a gradual manner by exposure and familiarity,

which means that the acceptance is a dynamic and context-sensitive one (Hameed et al., 2018). This provides the significance of step by step, well-justified plans of implementation, which conform to the local educational principles and practices.

Conclusively, adoption of technology in medical education is a complex process which depends on personal beliefs, organizational preparedness, cultural beliefs and national political climates. In the case of Pakistan, the process of improving the state of acceptance has to be the joint effort at various levels, which will encompass the development of infrastructure, faculty development, curriculum redesign, and favorable policy frameworks. It is by responding to these interrelated issues that the medical education institutions can be sure that technological innovation will add value to the quality of education, equity, and competence of the medical professionals trained in these systems, who are able to address the modern healthcare challenges.

## **Recommendations**

- Standardize national standards of technology in medical education in accordance to Pakistan Medical Commission standards.
- Invest in good digital infrastructure, especially in government and rural health facilities.
- Introduce ongoing faculty training on digital pedagogy and instruction design.
- Implement organized orientation and digital literacy education of medical students at the beginning of their courses.
- Incorporate educational technologies in the curriculum that has precise learning outcomes and alignment of assessment.
- Develop institutional technical support departments to help students and faculty.
- Promote the usage of mixed learning systems to achieve a balance between conventional education and technological advancement.
- Encourage medical education research in technology using grants and incentives.
- Overcoming cultural resistance by enlightening programs on the advantages of technology-enhanced learning.
- Provide equal access to devices and web resources to all medical students.

## **References**

1. Ahmed, S., & Khan, J. (2022). E-learning experiences of medical students in Pakistan during COVID-19. *Pakistan Journal of Medical Sciences*, 38(4), 987–993.
2. Cook, D. A., Levinson, A. J., Garside, S., Dupras, D. M., Erwin, P. J., & Montori, V. M. (2010). Internet-based learning in the health professions. *JAMA*, 300(10), 1181–1196.
3. Cook, D. A., et al. (2013). Technology-enhanced simulation for health professions education. *Medical Education*, 47(1), 87–98.
4. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
5. George, P. P., et al. (2014). Online eLearning for undergraduates in health professions. *Medical Teacher*, 36(2), 193–197.
6. Hameed, S., Badii, A., & Cullen, A. J. (2018). Effective e-learning integration in higher education. *Education and Information Technologies*, 23(1), 1–19.
7. Holden, R. J., & Karsh, B. T. (2010). The Technology Acceptance Model: Its past and future in health care. *Journal of Biomedical Informatics*, 43(1), 159–172.
8. Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2016). *NMC Horizon Report: Higher Education Edition*.
9. Khan, A., & Ahmed, N. (2021). Mobile learning acceptance among medical students in Karachi. *BMC Medical Education*, 21(1), 1–9.

10. Lateef, F. (2010). Simulation-based learning in medical education. *Journal of Emergencies, Trauma and Shock*, 3(4), 348-352.
11. Liaqat, H., et al. (2020). Challenges of online education in Pakistani medical colleges. *Health Professions Education*, 6(4), 1-7.
12. McGaghie, W. C., et al. (2011). A critical review of simulation-based medical education research. *Medical Education*, 45(1), 50-63.
13. Means, B., Toyama, Y., Murphy, R., & Bakia, M. (2013). The effectiveness of online and blended learning. *Teachers College Record*, 115(3), 1-47.
14. O'Doherty, D., et al. (2018). Barriers and solutions to online learning in medical education. *Medical Education*, 52(10), 1-11.
15. Pakistan Medical Commission. (2020). Standards for undergraduate medical education in Pakistan.
16. Peacock, J. G., & Grande, J. P. (2016). An online app platform enhances student engagement. *Anatomical Sciences Education*, 9(6), 1-10.
17. Riaz, A. (2023). Faculty perceptions of simulation-based education in Pakistan. *Medical Teacher*, 45(2), 156-162.
18. Ruiz, J. G., Mintzer, M. J., & Leipzig, R. M. (2010). The impact of e-learning in medical education. *Academic Medicine*, 81(3), 207-212.
19. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.



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