EDITORIAL

Revolutionizing Medical Education Through Digital Technologies

Muhammad Nadim Akbar Khan[1], Saadia Sultana[2], Noor-Mah Khan[3]

Digital technologies are electronic tools, systems, processes, devices, and resources that generate, store, or process data. Common examples are websites, video streaming, e- books, blogs, virtual patients, social media platforms (Facebook, Twitter, and Instagram), tools (personal computers, smart phones, tablets) and education-specific devices (data projectors, multimedia, simulators, digital cameras, digital stethoscopes, and laparoscopic simulators).

As a matter of fact, it is critical for medical educationists to have a basic understanding of these dependencies to make the best use of these technologies in their teaching. A wide range of available digital technologies support today's medical teaching, including content, tools, devices, systems, and processes, all of which are mutually dependent, and in turn, all rely on infrastructure. Furthermore, it is important to choose and use appropriate digital tools and processes that best meet their needs.

The effective implementation of technology-enhanced learning in medical education hinges upon the awareness and apt utilization of these technologies by medical educators. The significance and crucial role of digital technology in medical education became particularly evident and underscored during the Covid-19 pandemic. With the closure of medical schools, instructors transitioned to remote work, and students were compelled to participate in online classes, magnifying the importance of integrating digital technology in medical education. We discuss the utilization and integration of digital technology in medical education as follows:

- Significance and Advantages of Incorporating Digital Technology into Medical Education
- Guideline for Appropriate Timing and Methods for Utilizing Digital Technology in Teaching
- Addressing Challenges Associated with the Use of Digital Technology and Strategies to Overcome Them
- Involvement and Oversight of Institutions and Regulatory Bodies in Facilitating Digital Technology Integration

Significance and Advantages of Incorporating Digital Technology into Medical Education:

The incorporation of technology into medical teaching and learning is prompted by various compelling reasons. Digital technology has fundamentally transformed the accessibility, storage, and sharing of medical knowledge. The utilization of high-quality educational materials such as online courses, e-learning modules, and simulations has significantly elevated the standard of medical education, enabling instructors to remain abreast of the latest medical advances. While acknowledging the irreplaceable value of face-to-face teaching, especially in imparting clinical skills, it is imperative to recognize the indispensable role that technology plays in the contemporary era.

Internet technology, e.g. platforms like Moodle, contributes to enhancing connectivity and communication among all stakeholders within the teaching and learning system. Moreover, digital technologies enable the teaching of clinical knowledge and skills by connecting students across different locations with physicians and patients through telehealth networks, addressing the challenges associated with limited clinical learning opportunities. Additionally, technology-based teaching introduces the flexibility of asynchronous learning, empowering students to engage with the material at their own pace within specified timeframes.

Furthermore, the integration of technology facilitates innovative teaching and learning methods that foster critical thinking and problem-solving abilities in students. In a "blended learning

[1]*Department of Pathology/ Gynecology and Obstetrics*[2]
Islamic International Medical College
Riphah International University, Islamabad
[3]*MBBS, MD, MPH*
Harvard T.H. Chan School of Public Health
Massachusetts, USA

Correspondence:
Prof. Dr. Muhammad Nadim Akbar Khan
HOD Pathology
Islamic International Medical College
Riphah International University, Islamabad
E-mail: nadeem.akbar@riphah.edu.pk

Received: December 01 , 2023; Accepted: December 12, 2023

https://doi.org/10.57234/jiimc.december23.1959

environment," for instance, reading content is delivered in the form of text or online prerecorded lectures, allowing students to come prepared for classroom discussions and problem-solving activities. This dynamic approach to education opens avenues for creativity and adaptability in the pursuit of effective medical teaching.

Guidelines for Appropriate Timing and Methods for Utilizing Digital Technology in Teaching

Medical teachers should not only be aware of different available digital technologies but should also be mindful of when and how to use digital technologies in their teaching. *According to R. H. Ellaway, "we are currently training the last generation of doctors who can remember a time before the Internet, the first who will learn in an environment dominated by digital technologies and the first who will practice in a predominantly e-health environment. Medical teachers need to be attentive, reflective, and considerate in how they both use and respond to digital technologies.*"

When deciding on when to use digital technology in medical teaching, it's important to consider the goals and objectives of the course or program, as well as the skills and knowledge that the students require. Digital technology should be used to complement and enhance traditional teaching methods, rather than replace them. It is also important to ensure that students are equipped with the digital skills and literacy required to make the most of these technologies. This may include providing training and support in using virtual learning platforms, virtual-reality simulations, and mobile apps.

Different strategies can be used to adopt digital technologies in medical teaching. Teachers in the medical institutions should plan a strategy for the use of different technologies in their day-to-day teaching. They must consider different factors like, infrastructure and equipment - availability of PCs, laptop computers and connections to the internet, capabilities, aptitude and preferences of their students and the type of content to be included such as slide presentations, hand-outs, reading materials, audio and video, and resources for practical work, before incorporating these technologies into their teachings. Multimedia, overhead projectors and videos should be used for classroom teaching. Virtual patients for online teaching the clinical skills can be employed, and webinars may be arranged with MS teams and zoom. Instructors can share teaching materials and communicate with the students on educational projects through social media like WhatsApp, Twitter, Wikis etc. Teachers can also use these platforms to facilitate online discussions and debates. Work can be shared through blogs and educational videos on YouTube. Nowadays, technology is widely used for online assessment with quizzes or regular computer-based exams. Furthermore, post-hoc assessment analysis is now possible with the help of multiple software's.

Challenges Associated with the Use of Digital Technology and Strategies to Overcome Them:

The integration of digital technology into medical education offers numerous advantages, yet it is imperative to acknowledge and address certain drawbacks associated with its implementation. Cost stands out as a significant barrier, encompassing expenses related to acquiring computers, tablets, and educational software, potentially limiting access for both educational institutions and students. Moreover, issues of accessibility arise, as not all students may have equal access to the latest medical technology, potentially creating disparities in the learning environment.

Technical challenges, such as internet connectivity issues, hardware malfunctions, and software problems, pose potential disruptions to learning experiences and can impact student engagement. Another drawback is the potential lack of face-to-face interaction and collaboration intrinsic to traditional medical education, as technology-based learning can be isolated. Furthermore, while technology can enhance hands-on experiences in medical education, it cannot fully replace the indispensable practical exposure with patients, procedures, and equipment.

The assessment of practical skills, such as surgical procedures, through technology-based evaluations can be challenging, leading to potential limitations in accurately gauging students' abilities. Additionally, the risk of distraction, privacy concerns, and the potential for over-reliance on technology, to the detriment of problem-solving and critical thinking skills, further underscore the need for careful consideration.

In conclusion, while digital technology holds

significant promise for medical education, a balanced approach is crucial. It is essential to navigate these drawbacks judiciously and strive for a harmonious integration of technology-based learning with hands-on experiences to ensure a comprehensive and effective medical education.

Involvement of Institutions and Regulatory Bodies in Facilitating Digital Technology Integration:

Medical institutions play a pivotal role in the integration of digital technologies into medical education, shaping an environment that facilitates the effective use of these tools. This ensures that future healthcare professionals are adequately equipped to navigate the evolving digital landscape within modern medicine. To achieve this, institutions should integrate digital technology education into the curriculum, creating modules or courses focused on instructing students in the utilization of digital tools such as virtual reality simulations, telemedicine platforms, and AI-based diagnostic systems.

Facilitating training programs and workshops for both faculty and students is essential, enhancing their familiarity with emerging technologies and enabling faculty members to seamlessly incorporate digital tools into their teaching methodologies. Continuous support and professional development initiatives are critical to keeping educators up to date with the latest advancements. Establishing an assessment plan to evaluate students' competency in using digital tools ensures they acquire the necessary skills for contemporary medical practice.

Encouraging research initiatives in digital health education can drive innovations and improvements in teaching methodologies. The development of ethical guidelines for digital professionalism, encompassing issues related to patient privacy, data security, and the ethical use of AI and machine learning in healthcare, is imperative. Moreover, institutions must allocate budgets and resources to establish digital infrastructure, providing essential components such as computers, software, high-speed internet access, and devices conducive to digital learning.

In parallel, regulatory bodies can contribute by formulating guidelines and standards to evaluate the effectiveness and safety of digital tools employed in medical education. This proactive approach helps uphold educational standards while ensuring the reliability of technology-driven learning experiences.

The future of digital technologies in medical education holds great promise, with ongoing advancements paving the way for increasingly sophisticated virtual simulations, interactive online learning platforms, and augmented reality applications. The integration of artificial intelligence (AI) and machine learning has the potential to personalize learning experiences, offering adaptive feedback to students. Further enhancements, such as wearable devices, virtual reality, and haptic feedback, contribute to a more immersive and effective learning environment. However, ethical considerations, including data privacy and inclusivity, must be diligently addressed as these technologies evolve within medical education. It is a collective responsibility, encompassing teachers, students, medical institutions, and regulatory bodies, to champion and ensure the ethical and effective integration of digital technologies into medical education.

REFERENCES

1. Ruzevick J, Trueger NS, Thoma B, Ahn J, DaRosa D, Farach SM, et al. medical education resources on the internet: an association of program directors in surgery guide. J Surg Educ. 2020;77(6):1288-1298.
2. Aungst TD, Caballero J, Chen B, Cooley J, Craven K. Clinical virtual simulation in nursing education: randomized controlled trial. JMIR Nursing. 2020;3(1):e21484. DOI: 10.2196/21484.
3. House JB, Choe CH, Wourman HL, Hsu JR, Brown CVR. Augmented reality as a training tool for emergency procedures. J Grad Med Educ. 2019;11(4):464-468. DOI: 10.4300/JGME-D-19-00434.1.
4. Goh P-S, Sandars J. A vision of the use of technology in medical education after the COVID-19 pandemic. Med Ed Publish. 2020;9:49. DOI: 10.15694/mep.2020.000049.1.
5. Nicklen P, Keating JL, Paynter S, Maloney S. Exploring student engagement with a digital learning resource in musculoskeletal physiotherapy: a qualitative study. BMC Med Educ. 2019;19(1):289. DOI: 10.1186/s12909-019-1744-5.
6. Chretien KC, Tuck MG. Online professionalism: a synthetic review. Int Rev Psychiatry. 2015;27(2):106-117. DOI: 10.3109/09540261.2015.1009991.
7. Azer SA. Are we ready for flipped classrooms in medicine? Med Teach. 2015;37(1):1-6. DOI: 10.3109/0142159X.2014.943711.
8. Ruiz JG, Mintzer MJ, Leipzig RM. The impact of e-learning on medical education. Acad Med. 2006;81(3):207-212.
9. Shah SGS, Nogueras D, van Woerden H. The potential of virtual reality in medical education: a literature review. Med Educ. 2020;54(7):657-668. DOI: 10.1111/medu.14027.

https://doi.org/10.57234/jiimc.december23.1959

CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors have declared no specific grant for this research from any funding agency in public, commercial or nonprofit sector.

DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.