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EDITORIAL

Digital Medical Education: Opportunities and Challenges in a Transforming Landscape

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Revolution in the medical education is taking place under current impact of the new rapidly evolving digital world. Long isolated inside physical walls and hospitals, medical education is now venturing out into the dynamic world of virtual reality and it may change the way patients are treated for good. This transformation, further accelerated by the COVID-19 pandemic, represents a shift away from the traditional delivered teaching to increasingly active and experiential learning approaches. At the heart of this transformation is the metaverse an immersive virtual universe that, fuelled by technologies such as virtual reality (VR), augmented reality (AR) and mixed reality (MR), promises unprecedented benefits, but also introduces significant challenges to be navigated.[1-2]

Unlocking New Opportunities

The metaverse facilitates interactive, collaborative and multiplayer learning environment, diversified sensory channels and natural mistakes simulation in teaching and learning, which can significantly stimulate learners' interest, motivation and confidence. With it, users can form a team and play a virtual surgery or a simulated case discussion, which makes the learning significantly more interactive and efficient. For digital platforms, the ability to support the development of more advanced skills and procedural exposure by offering opportunities to practice complex procedures and situations requiring practical experience in a risk-free but marks-career safe environment is also reinforced, without causing any practical harm to patients. Metaverse solutions have been already applied for various medical specialities (surgery training, anatomy teaching, communication skills), such as VR-assisted intramedullary nail surgery, AR respiratory training for nurses and AR simulators for ophthalmology residents.[3,4]

Furthermore, highly realistic graphics, which can be used for visualization, lead to better knowledge acquisition and retention, while better learning results have been reported when teaching neuroanatomy in a mixed reality environment. Reference's advances in digital medical education delivers greater access and flexibility by removing the constraints of geography and providing real-time access to resources and expertise this is particularly important for learners in low resource and low to middle income countries. This method is also conducive to self-paced learning, which is especially useful for participants who have varying schedules and educational backgrounds.

Navigating the Challenges

Challenges Even with great potential, complete application and implementation digital medical education, especially metaverse digital technology, encounter terrible difficulty. Strictly speaking, the imposition of high costs to acquire high-end hardware like the AR/VR glasses and create detailed software, and to manage a sophisticated infrastructure are huge monetary obstacles. It works with the help of hardware that can become inconvenient and could result in discomforts such as irritability, nausea, eyestrain, fatigue, etc., that works against user acceptance and continued involvement.[3-4] The present level of VR, AR,

and MR technology for realistic presentation of human anatomy and disease states is still flawed. In addition, reliable high-speed internet access and high level of computing performance are necessary for optimal usability, but poor internet access, especially for LMICs, may limit the accessibility and immersion. There is also the absence of uniform protocol for the integration of these technologies in medical teaching curricula, which further limits their use across the globe.[5-6] Ethical and privacy dilemma also make integration difficult; data collection and analysis are large in quantity and the user-risk is an abuse of privacy like identity thefts and using private medical data, this justify the necessity to provide legal framework and privacy policy for data protection. Content integrity is also a concern of risks of mis-information, IP and copyright breaches, and inappropriate advertising in virtual environments that need rigorous governance and ethical guidelines.[4,5,6] They also can foster unrealistic perceptions of their clinical skills, which should be considered as adjuncts, not substitutes, to supervised practice. Social and pedagogical barriers compound this dilemma: technological disparities exacerbate the digital divide and hit marginalized communities, seniors and those living in low-income environments hardest. There is likely a learning curve for both the students and faculty, which can create resistance to new ways.

The Path Forward

The metaverse no doubt has tremendous potential to transform medical education and healthcare provision by providing avenues to a more personalized, efficient, and accessible training. Yet, achieving the vision demands both a combined effort across disciplines and a tool that goes beyond technological enthusiasm to seriously confront the remaining challenges: getting screwy ideas about screws back into tackle boxes.[5,7] It is critical that the ethical and regulatory framework specific to the metaverse is developed, including privacy, data safety, copyright, and accountability.[8] Equitable access will also need to remain a priority, with attention to developing low-cost, easy-to-use, and mobile friendly platforms to address the digital divide and to promote inclusivity, especially for learners in low and middle-income countries. Investment in teacher preparation, in terms of professional development programmes that enable teachers to develop digital skills, as well as pedagogical knowledge in the use of these tools, is essential.[9] Furthermore, use of blended learning models, combining computer simulated learning and traditional means can minimize the risk of excessive dependence on simulators while complementing the benefits of each into one. Finally, an even greater attention on evidence-based implementation for ongoing research to determine best practices, learning outcomes, and further developing metaverse applications to meet specific educational goals would be best.

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