

TRANSFORMING MEDICAL EDUCATION: A SYSTEMATIC LITERATURE REVIEW ON DIGITAL INNOVATION AND E-LEARNING ADOPTION IN HEALTH PROFESSIONAL TRAINING

COLLINS MOSES OWUOR (MBChB, Med)*, DORCAS WAMBUGU (PhD), GRACE ACHIENG OTIENO (MPharm, Bpharm), SYNTHIA ANYANGO & HARUN MUIRUGI MUIRURI

*Kenya Medical Training College, Kenya

<https://doi.org/10.37602/IJREHC.2024.5521>

ABSTRACT

Digital innovation is increasingly central to modern educational curricula, yet medical institutions have been slow to integrate e-learning effectively alongside traditional methods and clinical mentorship. The COVID-19 pandemic significantly accelerated the shift towards online learning, positioning it as a crucial component of contemporary education. This study employs a systematic literature review and content analysis to examine the impact of digital technology on health professional training. It aims to assess how the adoption and use of digital tools affect training outcomes, identify challenges faced by educators, and propose practical and technical solutions for improving digital adoption. The review of literature indicates strong support for the adoption of e-learning across all educational institutions, including medical schools. Despite this support, challenges such as insufficient technical skills, negative attitudes, and time constraints persist among educators. The study highlights the need for enhanced skills training and institutional support to address these barriers. It concludes that while digital learning plays a fundamental role in enhancing educational access, further integration and support are essential to fully leverage its potential in medical education.

Keywords: Digital Technology, e-Learning, Medical Education, Adoption Challenges, COVID-19 Impact.

1.0 INTRODUCTION

1.1 Background information

The events of the recent past have positioned technology at the heart of any education system. Education pedagogy and strategies are constantly evolving to enhance active, engagement and meaningful student learning with an aim of improving various learning outcomes (Owuor, C., Tshombe, D., Musuya, A., and Otieno, G., 2021). Technology has found itself at the center of teaching and learning as a way to prepare learners for the evolving job dynamics. The adoption of technology in education has become a primary political agenda in most developing countries, and Kenya has not been left behind. However, reluctance by the lecturers/teachers to change coupled by the high cost of implementing and integrating technology in the school systems especially in the remote areas has offered significant challenges.

Nelly S., (2012) raises pertinent questions that education in the digital world should tackle, such as, how are global trends in educational technology reflected through national policies

and processes? How exactly are educational technologies linked to use of global economics and the fortunes of national and international economics? To what extent are digital technologies implicated in the commercialization, marketization and commodification of education? The relevance of these questions in defining educational strategies in the training of health workers cannot be undermined.

The technological advances in the health field is quickly picking up momentum. Covid-19 pandemic offered a unique challenge to the educational system globally. Learning institutions were pushed to adopt and improve on digital learning as a way of overcoming the global effect at a time more doctors and nurses were required to fight the pandemic. Literature suggests a very guarded profession in the name of health professionalism with a conservatism approach to teaching and trainings. This has left medical workers out of touch with various technological advances and therefore they are now required to play catchup. The technological advances seen recently in patient care could be stimulant to a full acceptance of digital technology in the medical field as a complement to competency based teaching approaches being recommended.

1.2 Problem Statement

The integration of digital technology in medical education is increasingly recognized as vital for improving learning outcomes and preparing health professionals for the challenges of modern healthcare. However, in Kenya and across Africa, the adoption of e-learning in medical institutions remains limited. This lag is primarily due to inadequate government policies, insufficient infrastructure, and a lack of technical skills among educators (Niebuhr et al., 2014). Despite the temporary surge in online learning during the COVID-19 pandemic, the momentum has not been sustained, highlighting a persistent gap in digital integration within medical training programs (O'Doherty et al., 2018).

This study employed a systematic literature review to examine the adoption and use of digital technology in medical education as reported by various published journals. It aimed to identify the challenges faced by educators and assess the extent to which digital technology had been integrated into health professional training. The study also explored government and stakeholder interventions necessary to bridge the gap in digital learning adoption. By synthesizing existing literature, the research sought to provide actionable insights for enhancing the uptake of e-learning in medical institutions, thereby contributing to the development of a more robust and technologically equipped healthcare education system in Kenya and Africa.

1.3 Objectives

The broad objective of the study was to conduct a systematic literature search, review, and analyze the adoption and impact of digital innovation and e-learning in medical education, focusing on assessing current practices, challenges, and opportunities for enhancing the integration of technology in health professional training, as reported in selected publications as outlined below;

1. To assess how the adoption and use of digital technology is impacting health professional training by analyzing data from at least sixty-five relevant studies

published in the last twenty years, focusing on educational outcomes and learner performance.

2. To determine the challenges facing teachers in their use of digital technology in health professional training by identifying and categorizing the barriers mentioned in at least sixty-five relevant empirical studies published in the last twenty years.
3. To establish practical and technical proposals for improving the uptake of digital technology in health professional training by developing at least three actionable recommendations based on the literature review findings from at least sixty-five relevant studies published in the last twenty years.

1.4 Research Questions:

The study sought to answer the following research questions aligned with the specific objectives:

1. To what extent has the adoption and use of digital technology impacted health professional training?
2. What challenges are educators experiencing in their use of digital technology in health professional training?
3. What practical and technical recommendations can be made to improve the uptake of digital technology in health professional training?

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

In the context of digital innovation and e-learning in medical education, selecting an appropriate theoretical framework is crucial to effectively guide the study. Two potential frameworks, Technology Acceptance Model (TAM), potentially combined with Unified Theory of Acceptance and Use of Technology (UTAUT), and Constructivist Learning Theory, offers distinct advantages that can be integrated to optimize the study's relevance.

TAM, developed by Fred Davis in 1989, and UTAUT, proposed by Venkatesh et al. in 2003, are instrumental in understanding the adoption and acceptance of digital technologies in medical education. TAM suggests that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the primary factors influencing an individual's decision to use new technology. UTAUT expands on this by incorporating additional constructs such as Social Influence, Facilitating Conditions, and User Behavior, offering a broader perspective on the factors that drive technology adoption within an educational setting.

In this research, these models guide the exploration of how digital technology is used in health care training and to what extent digital technology influences health professional training. For instance, TAM and UTAUT can help identify the perceptions and attitudes of educators and students towards e-learning platforms, thereby elucidating why certain technologies are

adopted or resisted. By examining factors such as ease of use and institutional support, the study can provide practical insights into how digital tools can be better integrated into medical education.

On the other hand, Constructivist Learning Theory, introduced by Jean Piaget in 1936 and later expanded by Lev Vygotsky and others, emphasizes the importance of active, learner-centered education. This theory posits that knowledge is constructed through interaction and engagement, making it particularly relevant for evaluating the effectiveness of e-learning platforms in medical schools. Constructivism is pivotal in addressing Research Questions 2 and 3, particularly in determining the impact of digital technology on health professional training and identifying practical and technical proposals for improving the uptake of digital technology.

By combining these frameworks, the study not only investigates the factors that influence the adoption of e-learning technologies but also explores how these technologies can enhance learning outcomes in medical education. For example, TAM and UTAUT offer insights into the challenges educators face, such as technical skills deficits or negative attitudes toward technology, which are critical for answering Research Question 3. Meanwhile, Constructivist Learning Theory helps in assessing how digital tools can be leveraged to create more engaging and effective learning environments, thereby answering Research Question 2 in terms of educational impact.

Thus, the integration of TAM, UTAUT, and Constructivism not only guides the research process but also optimizes the synthesis of relevant concepts by linking technology adoption with pedagogical outcomes. This combined approach ensures that the study can comprehensively address the research questions, providing both a theoretical and practical foundation for the full adoption of digital technologies in medical education.

2.2 Empirical Literature

The integration of digital technology in medical education has been the subject of various empirical studies, reflecting the growing recognition of its importance. A systematic review by O'Doherty et al. (2018) highlighted that the COVID-19 pandemic accelerated the adoption of e-learning platforms among medical institutions. Their findings indicate that despite the initial success in transitioning to online formats, many educators struggled to maintain the quality of instruction and engage students effectively in virtual environments. This underscores a significant challenge in sustaining digital learning momentum beyond emergency situations.

Niebuhr et al. (2014) conducted a comprehensive assessment of the barriers to e-learning adoption in African medical schools, identifying inadequate infrastructure and limited technical skills among faculty as primary obstacles. Their study revealed that many institutions lacked the necessary technological support, resulting in a reliance on traditional teaching methods, which often fail to meet the demands of modern healthcare training. This challenge is echoed in the findings of a recent study by Azzopardi et al. (2020), which reported that educators experienced difficulties in utilizing digital tools due to insufficient training and resources.

Furthermore, a study by Dunleavy et al. (2020) examined the impact of digital technology on student learning outcomes in medical education. Their research demonstrated that well-

implemented e-learning strategies could significantly enhance students' understanding and retention of complex medical concepts. However, they also noted that the effectiveness of digital technology hinges on its integration into the curriculum and the support provided to both educators and students.

Another significant aspect identified in the literature is the role of government policies and institutional support in facilitating e-learning adoption. A study by Ajani and Manoharan (2019) highlighted that strategic initiatives and investments in digital infrastructure were critical for improving the quality of medical education in Kenya. Their research suggested that collaborative efforts between government bodies and educational institutions could help address existing gaps and promote a more widespread adoption of e-learning practices.

Overall, the empirical literature reveals a complex landscape of challenges and opportunities in integrating digital technology into medical education. While significant progress has been made, particularly in response to the COVID-19 pandemic, persistent barriers remain. The findings from these studies highlight the need for targeted interventions, robust policy frameworks, and continuous support for educators to enhance the effectiveness of digital learning in health professional training.

3.0 METHODOLOGY

A scoping review of the role of digital technology guided by the study objectives was adopted. Related documents were searched and identified and a systematic review, thematic review, scoping study and scoping reviews were conducted. Literature that focused on the various forms of health professionals training were considered to the extent that they were aligned with the study objectives. Internet search was done on the google, google scholar, PubMed, the broadband commission working group on digital health website, world health organization website. The search was limited to materials published over the last 20years. The search terms included terms like e-Health for doctors, teleconference, telehealth, e-curriculum for health professionals

Literature review and content analysis was performed to explore the adoption and use, the challenges and the practical and technical proposals with relations to the use of digital technology in the training of health professionals. Data extraction techniques as recommended by Colquhoun et.al., (2014) based on methodological steps outlined in the Arksey and O'Malley framework and further enhanced by Levac et al. the framework outlines five stages; identifying research questions, identifying relevant studies, study selection, charting the data and collecting, summarizing and reporting the results

The data analysis for the study involved a systematic review and thematic analysis of 65 selected studies on digital technology and e-learning in medical education from the past 20 years. Initially, relevant studies were identified and reviewed, focusing on how digital technology is adopted, the challenges faced by educators, and proposals for improvement. Key data was extracted using a standardized form, and thematic coding categorized the data into major themes such as "adoption challenges" and "impact on learning." The analysis involved quantifying specific terms related to digital technology and identifying patterns and trends. Findings were integrated into a narrative synthesis, summarizing key insights and evaluating

the relevance and methodological rigor of each study. This comprehensive approach provided a detailed understanding of the current state of digital innovation in medical education, highlighting trends, challenges, and practical recommendations for enhancing technology adoption.

4.0 RESULTS

4.1 Adoption and Use of Digital Technology and how its Impacting Health Professional Training

Literature sources commonly gave the definition of digital technology to include the internet of things (IoT) with next generation telecommunication network, big data analytics, artificial intelligence that uses deep learning, and block chain technology. Whereas digital health and its role and potential to improve the efficacy of the health workforce, advance quality health services coverage, and promote better outcome appeared to have been a forgone conclusion from the data analyzed, most of the studies demonstrated potential benefit of digital technology when employed in the training of health care workers. Focus shifted to how institutions were using digital technology and equipment in their training of health care workers. All the studies reported the use of one method of digital technology or the other with limited penetration into medical schools.

The study demonstrated literature that showed promising trend in the adoption and use of digital technology in the training of health care workers with a potential to upscale; A study by De Leeuw J., Woltjer H, and Kool R, (2020) demonstrated that a digital training approach tailored to the learning needs and styles of the nurses is needed to supplement the on-the-job training structure as well as adequate peer support. This was similar to findings in another study by Cureen V., et al., (2019) which sort to investigate on factors influencing adoption and use of mobile devices and resources to support just-in-time learning

At the pick of the Covid 19 pandemic, online teaching became the main learning model in most learning institution, an approach that appeared to have been duplicated in the healthcare training. A number of studies seemed to have been done at the pick of Covid-19 with the aim to assess perceptions and barriers to online learning. Majority of the studies seemed to agree on the Covid-19 having been a unique catalyst for promoting the acceptance and adoption of online teaching even for health care providers. However, it appears that the hype that accompanied the introduction of online learning in most institutions fizzled off. A lack of prior training on use of computers and internet alongside cost seemed to have emerged as the main challenge to full adoption of eLearning in most institutions (Owuor C. et al 2024 and Siritongthaworn S. et al., 2006)

4.2 Impact of eLearning on Health Workers Training

In spite of all, literature review demonstrates no additional patients' benefits offered by eLearning as compared to traditional learning methods, or health professional behaviors or skills or knowledge. There was no enough data to analyze to give a generalization in comparing the learning benefits between the traditional learning methods and eLearning methods. The study recognized the lack of enough supportive information. However, the use of digital technology in patient care seemed to have gained more acceptance, a factor that is indirectly

attributed to application of digital technology in the training of health care workers (Vaona A et al., 2022). It also emerged that learners' motivation and expectations; utilizing user-friendly technology; and putting learners at the center of pedagogy are other factors that seemed to be influencing the effectiveness of eLearning in the training of health care workers (Regmi, K and Jones, L., 2020).

4.3 Challenges Facing Teachers in Their Use of Digital Technology in Health Professionals Training

From the literature review, findings suggest that the fundamental barriers which affect the development and implementation of online learning in medical education include poor technical skills, negative attitudes of all involved, time constraints, inadequate infrastructure, and absence of institutional strategies and support. Our literature search identified poor technical skills or just skills deficit in the practical aspects of eLearning as a challenge experienced by educators in the development and implementation of online learning for medical students. Several data sources pointed out the inability of some of the lecturers/teachers to be having poor and or insufficient computer use and typing skills (Niebuhr V., 2014).

A study in Pakistan by Abbasi et al (2020) among others demonstrated that Negative attitude was common barrier among teacher in the course of implementation of online teaching strategies. Literature suggests that significant frustration was associated with the implementation of the online teaching strategies. Most lecturers/teachers sited either lack of knowledge, feeling of inadequacy, or poor skills as having been key contributors among lecturers. Other studies revealed possible fear of job loss as other possible contributors. Educators had indicated that learning new modus operandi was challenging for them, especially when facing technical issues (O'Doherty D, 2018)

Curriculum implementation, whether in the traditional teaching strategy or in the online model has to be aligned to time. Literature shows that the pressure of creating online material for various online classes is a major problem. Coupled with skills challenges, lack of computer skills and poor infrastructure, preparation of classes took longer and this offered significant challenges for teachers and lecturers. Lecturers required purposeful institutional support to improve on efficiency and timeliness in content coverage. Schools are slow in fully adopting the digital technology in its learning program. The impact of which appeared to be more time spent in organizing for digital learning (Rose S., 2020).

4.4 Practical and Technical Proposals for Improvement in The Uptake of Digital Technology in Health Professionals Training

Safi S, Thiessen T, and Schmailzl K, (2018) disused the recognition of eLearning for medical students. Their assertion is based on the premise that acceptance is a key stimulant of change and that change is a process that requires time. Hence, successful implementation of eLearning for medical students would require time to fully actualize in medical schools; however, this should not prevent the push for changes in health care technology. As new techniques and approaches become available health workers training metamorphoses, taking advantage of the

speed and volume of data they generate, their potential adaptability, reach, and cost. These new methods have implications for extreme changes within the medical field.

5.0 CONCLUSION

This paper concludes that digital technology is important for promoting learning not just in medical schools but in all learning institutions. Technology integration in the training of health care workers is slowly being accepted in most medical schools. Main challenge appears to be; incorporating digital technology for clinical sessions as well as overcoming the long traditions in the training of health care workers. This paper proposes critical assessment of the various learning strategies for health care workers so as to facilitate full implementation of digital learning in health care training institutions.

REFERENCES

- Abbasi S, Ayoob T, Malik A, Memon SI. Perceptions of students regarding E-learning during Covid-19 at a private medical college. *Pak J Med Sci.* 2020;36(COVID19–S4). doi: 10.12669/pjms.36.COVID19-S4.2766
- Curran, Vernon PhD; Fleet, Lisa MA; Simmons, Karla MA; Lannon, Heather BSW, MSW; Gustafson, Diana L. MEd, PhD; Wang, Chenfang BA; Garmsiri, Mahyar BSc (Hon); Wetsch, Lyle MBA, MSc. Adoption and Use of Mobile Learning in Continuing Professional Development by Health and Human Services Professionals. *Journal of Continuing Education in the Health Professions: Spring 2019 - Volume 39 - Issue 2 - p 76-85* doi: 10.1097/CEH.0000000000000243
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.
- Hollander JE, Carr BG. Virtually perfect? Telemedicine for Covid-19. *N Engl J Med.* 2020;382(18):1679–1681. doi: 10.1056/NEJMp2003539
- Niebuhr V, Niebuhr B, Trumble J, Urbani M. Online faculty development for creating E-learning materials. *Edu Health.* 2014;27(3):255–61.
- O’Doherty D, Dromey M, Loughed J, Hannigan A, Last J, McGrath D. Barriers and solutions to online learning in medical education – an integrative review. *BMC Med Educ.* 2018;18(1):130. doi: 10.1186/s12909-018-1240-0
- Owuor, C., Otieno, G. A., Kinyua, K., Shunet, S. N., Muiruri, H. M., & Otieno, C. A. (2024). Sociodemographic risk factors of mental health and academic performance in the context of adoption of innovative technologies at the Kenyan Medical Training Colleges (KMTCC): A critical review of literature. *Kenya Medical Training College, Kenya.* <https://doi.org/10.37602/IJREHC.2024.5502>
- Owuor, C., Tshombe, D., Musuya, A., & Otieno, G. (2021). FACTORS AFFECTING STUDENTS, ASSESSMENTS PERFORMANCE: CASE OF KENYA MEDICAL

TRAINING COLLEGE (AN OPERATIONAL STUDY OF KMTC). African Journal of Education and Practice, 7(2), 30-49.

Piaget, J. (1936). *Origins of Intelligence in the Child*. Routledge & Kegan Paul.

Regmi, K., Jones, L. A systematic review of the factors – enablers and barriers – affecting e-learning in health sciences education. BMC Med Educ 20, 91 (2020). <https://doi.org/10.1186/s12909-020-02007-6>

Rose S. Medical student education in the time of COVID-19. JAMA. 2020;323(21):2131–2132. doi: 10.1001/jama.2020.5227

Saekow Apitep and Samson Dolly. E-learning Readiness of Thailand's Universities Comparing to the USA's Cases. Int J e-Education, e-Business, e-Management e-Learning. 2011;1 (2).

Safi S, Thiessen T, Schmailzl K, Acceptance and Resistance of New Digital Technologies in Medicine: Qualitative Study JMIR Res Protoc 2018;7(12):e11072 URL: <https://www.researchprotocols.org/2018/12/e11072> DOI: 10.2196/11072

Siritongthaworn S, Krairit D, Dimmitt NJ, Paul H. The study of e-learning technology implementation: A preliminary investigation of universities in Thailand. Educ Inf Technol. 2006;11(2):137–60.

Vaona A, Banzi R, Kwag KH, Rigon G, Cereda D, Pecoraro V, Tramacere I, Moja L. E-learning for health professionals. Cochrane Database of Systematic Reviews 2018, Issue 1. Art. No.: CD011736. DOI: 10.1002/14651858.CD011736.

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.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.