

The Effectiveness of Multimedia Distance Education in Saudi Higher Education and the Development of Nurses Knowledge and Skill: An Integrative Review

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Abstract

Background: The Covid-19 pandemic has required the world's educational sector to rapidly adjust its delivered methods and not to be too dependent on face-to-face interactions. The Ministry of Education in Saudi Arabia took advantage of what was already a well-developed common digital platform to extend its use of multimedia remote working. Aim and methods: This integrative review aims to address the effectiveness of multimedia distance education on university students and in particular nurses' knowledge and skill development. Result: Eighteen articles were included and organized into two themes: what Types of multimedia methods are there in use for skills development and effectiveness of multimedia methods at augmenting practical skills in the Kingdom of Saudi Arabia. **Summary:** The challenge in the post-pandemic era for Saudi health care education is to conduct a fresh examination of how and what types of e-learning or m-learning can supplement or augment nurses knowledge and practical skills development. However, the principal lesson to be learnt from this review is that the technological development and design of any of the systems has to meaningfully address the learners' needs and not just simply drive learning per se. Key messages: Saudi Arabia's Universities are well situated to take full advantage of the expansion of e-learning initiatives. Nursing Departments need to explore the use of augmented reality to improve the development of practical knowledge and skill, but what is developed must be driven by the learner's individual ability and needs.

Keywords: E-learning, nurses student, Multimedia, Learning, covid-19, Saudi Arabia.

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INTRODUCTION

The Kingdom of Saudi Arabia (KSA) like other countries has been affected by the Covid-19 pandemic, the impact of which has been not only economic (Havrlant, *et al.* 2021) and psychosocial (Hammad, & Algami, 2021) but also educational (Tanveer *et al.* 2020). Praised by UNESCO for its prompt response to the pandemic and the protection of its educationalists, the Ministry of Higher Education took advantage of its robust common digital platform to extend its use of multimedia remote working. This freely available and extensive electronic infrastructure was already a key part of the country's long term planning articulated in Vision 2030 with over 98% of all citizens having mobile internet access most of the time.

Remote learning led by the Saudi education sector (Mitchell & Alfuraih 2018), established the first e-learning and distance education degree and continuing

education programmes (Alahmari, 2017). The National Center for e-Learning established in 2005 is linked but independent of the Ministry of Higher Education has the strategic role of controlling the quality of e-learning by regulation, setting standards and controlling licenses for developers and institutions. The lack of awareness of the Center's existence by senior Saudi academics at an e-learning conference in Manchester UK was attributed to the different universities organization of their systems and the lack of any official oversight but seen as both a possible strength and inevitable weakness (Al-Shehri, 2010).

For health care, professional educators in particular the challenge of increasing the amount of multimedia distance learning provision, whilst similar to other university theoretical programmes, raised several other complex questions. Those concerned were primarily about how these students obtain the necessary practical skills that are sufficient for competent, safe and reliable professional practice. Yet a systematic

review by George *et al.* (2019) concluded that the evidence was that these concerns may be baseless and that e-learning may be superior to that of traditional methods. However, in an earlier review by Sinclair *et al.* (2016) there was insufficient proof that e-learning had any impact on healthcare professional skills and behavior or patient outcomes. This integrative review aims to address the effectiveness of e-learning and multimedia distance education on students as well as nurses knowledge and skill development and what lessons can be learnt as a consequence of the Covid-19 pandemic.

METHOD

An integrative review is considered to be a comprehensive method of undertaking a review of the known literature but differs from other appraisal methods such as meta-analyses or a systematic review. According to Booth *et al.* (2016), the purpose of undertaking any review of the research literature is to increase our understanding of what evidence is in the public domain to understand the main issues surrounding a particular subject and fully understand the gaps in the available knowledge.

An integrative review is according to Whittemore, & Knafl, (2005) a complex non-experimental research method considered to be a wide-ranging and comprehensive means of undertaking a literature review and analysis. It differs from other appraisal techniques such as meta-analyses or a systematic review as it combines data from a diverse selection of data sources such as theory, experimental, non-experimental studies and even where appropriate expert opinions. Their five stages of the review process are problem formulation, the search strategy, evaluation, analysis of selected data, presentation of findings and limitations.

Integrative reviews have become increasingly popular in nurse education research per se (Bvumbwe & Mtshali *et al.*, 2018; McCarthy *et al.*, 2018; Derico, 2017; Glerean, *et al.*, 2017:), reviews of clinical skills development (Al-Thubaity, *et al.*, 2019; Bhurtun, *et al.*, 2019; Kinghorn, *et al.*, 2017) and increasingly so on the topic of understanding how effective technological developments is at augmenting practice (Gerup, *et al.*, 20020; McDonald, *et al.*, 2018; MacLean, *et al.* 2017). Nevertheless, Hopia *et al.* (2016) suggest that the technique is not without criticism as they found significant problems with variations in the approaches to methodological rigour. The very diversity of the literature sources can contribute to selection bias and a loss of consistency produced incoherent data evaluation, analysis and interpretations (Whittemore, & Knafl, 2005).

The Review Strategy

The aim of this integrative review is to deploy a detailed search strategy in order to locate and

critically summaries the relevant international empirical literature that is available. Firstly, on the multimedia types and how its effects the knowledge development. Secondly, to explore the effect of e-learning on the practical skill of nursing students in Saudi Arabia.

The first stage in the review is framing the search question and objectives, which Booth and Cleyle (2006) advice using the PICO (population, intervention, control, and outcomes) acronym format to improve the precision of the selection of the keywords.

- Population: KSA and University Students
- Intervention: Multi-Media Learning
- Control: Skills and Clinical Practice
- Outcome: Effectiveness and Development

The keywords were derived from the formatted question which became:

- *How effective is multimedia learning for university students skills development in KSA*
- The objectives became:
- What types of multi-media methods are there in use for skills development in KSA
- What methods are effective at augmenting practical skills in KSA

After framing the review question, it is recommended (Hart, 2001) to search the literature, using the key words that originate from the question formulation. English was used to undertake electronic databases searched from PubMed, Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Education Resources Information Center (ERIC) search engines from 2010 to the present date. Terms used were: E-learning, nurses student, Multimedia, covid-19, Saudi Arabia, distance learning, and practical skills. The inclusion criteria were set to English or Arabic language full-text articles or reports, and publication from 2010-2021. Manual searches were also performed in article reference lists and journals.

The initial board sweep resulted in 275 higher education articles of which 64 originated in KSA. On further refinement to reflect aspects of health care and nursing, in particular, they were reduced to 18 but exceptionally two Swedish studies were included, as they were considered pertinent. These articles were evaluated analyzed and organized into two themes before given a final quality assessment (Nutley *et al.* 2012). Most of the literature appraisal tools use hierarchies based on the validity of the research rather than the contribution of all types of research and opinions, but Hawker *et al.* (2002) was used (Table 1), because it incorporates diverse methodologies which gave each paper a score out of 36 and produce clear overall results.

Table-1: Quality Rating of Publications Included

	Title	Author/s /Country	Type of study	Quality Rating /36
1	The Developments of ICT and the Need for Blended Learning in Saudi Arabia	Dr. Majed Gharmallah Alzahrani, 2017 University of Jeddah, Saudi Arabia	Literature review	20
2	Undergraduate nursing students' perception and usage of E-learning and blackboard learning system	Mona Mohamed Megahed Elbasuony <i>et al.</i> , 2018 King Khalid University, Kingdom of Saudi Arabia	Descriptive study	30
3	The reality of using smartphone applications for learning in higher education of Saudi Arabia. PhD thesis.	Aljaber, Abdullah (2021)	Mixed methods research approach within a case study university; the Saudi Electronic University PhD thesis	29
4	The readiness of applying mlearning among Saudi Arabian students at higher education	Almutairy, S. M., Davies, T. and Dimitriadi, Y. (2015) Saudi Arabia	Descriptive study	22
5	The degree of mobile phones applications use by the University of Taibah in the Kingdom of Saudi Arabia and their obstacles to use	Alinzi, S. (2012), master's thesis. Saudi Arabia	Descriptive study	20
6	Perception of Students about E-learning: A Single-center Experience from Saudi Arabia	Hussein Algahtani, <i>et al.</i> (2020) Saudi Arabia	Cross-sectional study	29
7	E-learning success factors: comparing perspectives from academic staff and students. Computers and Education.	Alhabeeb, A and Rowley, J (2018) Saudi Arabia	Descriptive study	21
8	Influences on the Adoption of Mobile Learning in Saudi Women Teachers in Higher Education	Leena Alfarani King Abdulaziz University 2015 Saudi Arabia	Descriptive study	23
9	Attitude of Nursing Students towards Computer Assisted Learning in a Selected Nursing College,	Bindu Kaipparettu Abraham, Selwa Y Abdeldafie, University of Hafr Al Batin (2015) Saudi Arabia	Descriptive study	25
10	Nursing Students' Readiness for e-Learning Experience	Wafaa Ali, 2016 Shaqraa University. Saudi Arabia	Cross-sectional study	31
11	Effect of Traditional versus E-learning on nursing Students' Academic Achievement	Fatma Mostafa Mahrous and Jackleen Faheem Gendy , 2015 King Khalid University, Saudi Arabia	Quasi-experimental design	32
12	Critical Success Factors for the Adoption of eLearning in the Kingdom of Saudi Arabia Educational Institutions	Fryan, L. B., & Stergioulas ,2011 Saudi Arabia	Scoping Review	20
13	An Experimental Study On Usefulness Of Virtual Reality 360° In Undergraduate Medical Education	Sultan L <i>et al.</i> , 2019 King Saud bin Abdulaziz University Saudi Arabia	Quasi-experimental study	31
14	Simulation-based medical teaching and learning	Al-Elq, A 2010 University of Dammam, Saudi Arabia	Narrative review of literature on a medical simulator	24
15	The Use of Avatars in Gender segregated Online Learning within MOOCs in Saudi Arabia	Raniah Adham, <i>et al.</i> , 2016 Effat University Saudi Arabia	Exploratory case study Mixed-methods approach	21
16	Experiencing virtual patients in clinical learning: a phenomenological study	Samuel Edalbring <i>et al.</i> , 2011 Stockholm, Sweden	Qualitative study using phenomenological approach	23
17	Augmented Reality in healthcare education: an Integrative review	Egui Zhu <i>et al.</i> , 2014 Stockholm Sweden	Integrative review	21
18	Augmented Reality: A Systematic Review of Its Benefits and Challenges in E-learning Contexts	Nouf Matar Alzahrani. 2020 Albaha University, Saudi Arabia;	Systematic Review	30

RESULT

This review included 18 studies and presented under two separate themes, which emerged from the recurrent content in the literature and answered the review question. The first theme is what types of multimedia methods are there in use for skills development in KSA. The second theme is what multimedia methods are effective at augmenting practical skills in KSA.

Theme 1: What types of multimedia methods are there in use for skills development in KSA

There were 12 publications included in this theme. All from Saudi Arabia, a Quasi-experimental study on the effect of e-learning by (Mahrous, & Gendy, 2015); two cross sectional studies about e-learning experiences (Algahtani *et al.*, 2020; Ali, 2016); five Descriptive studies on undergraduate nursing students' perception and usage of E-learning, mobile phones applications and attitude of nursing students towards computer assisted learning (Elbasuony *et al.*, 2018; Almutairy *et al.*, 2015; Alhabeeb, & Rowley, 2018; Alfarani, 2015; Abraham, & Abdeldafie, 2017); two Literature review about the developments of information and communication technology ICT and eLearning users perspectives (Alzahrani, 2017; Fryan & Stergioulas, (2011); and lastly a mixed method research (PhD thesis) explored the using smartphone applications for learning in higher education in Saudi Arabia by (Aljaber, 2021).

Electronic learning (e-learning) systems are free from limitations such as time and space; they include learning that is fully dependent on information technology. Blended learning involves a mix of traditional classroom-based learning methods and e-learning. Most universities including the Kingdom of Saudi Arabia (KSA) now use the USA developed Blackboard system (Alzahrani, 2017). In a study of undergraduate nurses, digital competence in their blackboard usage, Elbasuony, *et al.* (2018) found that although the students' valued e-Learning the majority of them found the systems features unsatisfactory. Other studies of the system by Aljaber, (2021) used a mixed methodology with Saudi students also found that the Blackboard application whilst having all the necessary appropriate functionalities that supported blended learning, considered more could be done to improve its cultural relevance to KSA students.

This view was supported by Aljaber, (2021) who also concluded that the ability to articulate the blackboard system with smartphone applications could be adapted to make mobile learning (m-learning) using SMART technology easier. The majority of academic lecturers found smartphone better for Saudi students than desktop computers because of their convenience and they believed it enhanced their teaching and use of social media. Other benefits and disbenefits were reported by both users had wider implications than just

simply usability. In a survey of Saudi students studying in the UK use of mobile learning by Almutairy, *et al.* (2015) they found it is not only allowed students access to the knowledge needed to understand their academic subject but also improved their learning acquisition skills and develop their knowledge. But an earlier survey by Alinizi (2012), found the biggest challenge they faced was the reluctance of their faculty to let them have access to their mobile phones viewing it as an entertaining distraction and forbidding its use during lectures. Despite the reluctance of faculties to modernise their thinking, Algahtani *et al.* (2020) cross-sectional study of health care students concluded that mobile phone use was a factor in significantly boosting students' critical thinking and was supported by them as a teaching method.

In what can be regarded as still in its developmental stage e-learning can be used for simple course administration such as registration, timetabling, and faculty updates. But can then be expanded to facilitate access to knowledge content and collaboration between learners and their lecturers in a shared online environment. The first attempt at a comprehensive study of eLearning users perspectives in the Saudi context was reported by Fryan & Stergioulas, (2011) in conference proceedings, and was followed up by Alhabeeb, & Rowley (2018) and both found differences in perspectives between students and instructors. Students valued the usability and availability of the technological infrastructure and the experience and enthusiasm of their instructor. Whereas the teachers valued the type of e-Learning system in use and the student's digital literacy as critical to their learning success. Saudi women lecturers, in particular, those that acknowledged having to cope with gender cultural obstacles to their teaching of mixed groups were found by Alfarani (2015) to appreciate the potential for e-learning to improve communication with all their students.

From a nursing perspective, Abraham, & Abdeldafie, (2017) attitude survey claims that nurses must be prepared to develop information technology skills to advance nursing science and practice. They found nursing students generally accepted that computers assisted their learning, but those with access to a home computer and had therefore more digital experience were more assured of their value. The findings are supported by Ali (2016) whose cross-sectional study showed that nursing students were ready and supportive of e-Learning initiatives. Also whilst having a home computer whilst an advantage is not a hindrance to nurses developing skills with web-based systems. As Mahrous, & Gendy, (2015) established in their quasi-experimental study found that whilst nurses practical skills were not improved by developing an e-learning system; their fundamental knowledge acquisition was significantly improved compared to traditional teaching methods.

Theme 2: What multimedia methods are effective at augmenting practical skills in KSA

The second theme to emerge from the review concerned augmented reality and practical skills. There were six publications included in this theme. A Quasi-experimental study by (Sultan *et al.*, 2019) explored the Usefulness Of Virtual Reality 360° In Undergraduate Medical Education; an Exploratory case study discuss the Use of Avatars in Gender segregated Online Learning (Adham, *et al.*, 2016); a Systematic Review explored the Benefits and Challenges in E-learning Contexts (Alzahrani, 2020); a literature review discussed Simulation-based medical teaching and learning (Al-Elq, 2010), two Swedish studies included for its relevant regarding augmented reality and clinical learning (Edelbring *et al.*, 2011; Zhu *et al.*, 2014).

Augmented reality (AR) allows a real-time direct or indirect world environment to be enhanced by a computer-generated virtual image. Virtual environments or online-created three-dimensional spaces where learners can use an avatar to interact with other images and objects. It is a technology that Wüller, *et al.*, (2019) scoping review indicates that simply wearing computing such as smart glasses enables nurses to overcome the challenges of gaining practical skills remotely. It makes changes to the wearer's perception of their real world by supplementing and enhancing it with virtual information. However, earlier reviews of the literature by Zhu *et al.* (2014) found that most of the studies in health care education concerned pilots of early AR prototypes, without any explicit pedagogical theoretical framework and which did not integrate safe clinical practice skills.

In Saudi Arabia, the education studies into AR have predominantly been in medicine rather than nursing, but with the possibility of some crossover where skills are complementary. An example of which is Sultan, *et al.* (2019) experimental study on the usefulness of an Australian virtual reality programme that used 360 degrees VR videos of real or simulated places related to communication skills in undergraduate medical education. Not only were the experimental students in favour of this type of learning but their post-test multiple-choice test results also were significantly improved compared to the control group. They conclude that VR could offer the opportunity to provide a cost-effective safe learning environment for repetitive practice without any risks to patients. Al-Elq (2010) also examined the adoption of VR in anatomy medical education in Saudi Arabian students using the Voxel-Man TempoSurg simulator. Both students and learners found the virtual environment was a powerful cost-effective learning tool with the potential to improve patient safety by increasing student competence and reliability.

Another general VR innovation in KSA higher education reported by Adham *et al.* (2016) in

conference proceedings was the adoption of a female Tutor Avatar to present online courses. It was developed to resolve the issue of gender segregation in online communities where female academics are reluctant to physically appear to present their courses. Its adoption was limited by both technical problems and some student's and other teachers willing to accept the avatar. Acceptance of patient avatars was studied in Sweden (Edelbring *et al.*, 2011) where students regarded them as emotionally stunted. However, they did promote the students clinical reasoning and made decision-making less stressful than real physical patient encounters. Rather than substituting clinical experience, it was seen as an effective means of making the transition to dealing with clinical complexity.

The students' approval and teacher reluctance was confirmed in Alzahrani's (2020) systematic review of the topic for the Saudi Universities. He found AR improved the students' engagement and motivation to learn, by focusing their attention and concentration. It also improved their access to information and resulted in increased knowledge retention. The downside for students was the exposure to cognitive overload and ineptitude with using the technology involved. From the teachers' perspective, it was the resistance to abandon traditional teaching methods, their lack of training in new technology and the cost of that investment.

DISCUSSION

The pandemic has and continues to necessitate a rapid adjustment of Saudi educational practices and methods. It requires Saudi academics to adopt and adapt technological solutions to replace and enhance the accepted and deeply culturally routed traditional methods they were found to favour by Alhabeeb, and Rowley, (2018). Since students and academic staff differ in their perspectives its essential that students disparate learning is accommodated by academics, both in curriculum design and the types of technological solutions utilized (Ferguson, *et al.* 2015).

Plainly smart phone technology has an important part to play, in that it is cost effective and all pervasive in Saudi society. More importantly, the Saudi common digital platform ensures that were nurse educationalists to invest in their professional technological development, they can readily develop and enhance the use of their mobile teaching and learning in all settings including clinical areas.

Smart phone technology is already improving Saudi health care professionals' clinical communications, creating virtual teams that are gender free and approved by Islamic law (Kamel Boulos *et al.*, 2016; Van Geel, 2016). For the student it could mean that expert opinions and assistance are readily available in the clinical environment and that information and learning can be accessed as and when needed. Nevertheless, the new era of health care technological

innovation according to Alzahrani, (2020) resides in the application of Augmented Reality and Gaming for both patients and health professionals. He suggests that at a fundamental level it produces the kinaesthetic or practical learning, highly valued by nurses because it leads to faster mastery of complex learning situations, collaborative working and a smooth transition from virtual to real word.

Gaming on the other hand is a means of AV simulation that many students enjoy but also allows them to access their developing competencies (Al-Elq, 2010). However, the technology remains underdeveloped and utilized when the acquisition of appropriate clinical skills is acknowledged as vital for patient safety. Yet Saudi students can continue to complete their educational programmes with theoretical knowledge but may lack many of the clinical skills vital for their clinical practice judgements (Almutairi, *et al.* 2015). The solution is not to produce more traditional methods to rectify these problems but to find solutions that multimedia technology is superior at creating the controlled safe space for students to learn and perform at the level of competency the client base has a right to expect.

Limitation

The main limitations of the review were that the weaker studies lacked sufficient detail, and data collection methods. Despite these limitations, the author believes that this review will still be significant around this topic and has added to the knowledge base in this field.

CONCLUSION

The pandemic has taught educationalist not to be too dependent on face-to-face interactions, post-pandemic a fresh examination is required of how e-learning or m-learning can supplement or augment knowledge and skills development for all university students.

It is also evident that whatever technology is used, there will still be significant barriers to overcome in acceptability, accessibility and usability of learning content whatever the learners' or lecturers' experience or indeed their generation. However, the principal lesson to be learnt from this review is that the technological design of any of the systems has to address the learners' development needs not drive the learning by itself. Whilst the clear proven benefits of knowledge acquisition must be advanced with progressing the utility and integration of smartphones and tablets with the main blackboard system, nevertheless in nursing innovative strategies such as VRS for practice skills development need urgent attention.

These new fit for purpose technologies that create a synthetic environment are still underdeveloped

and underestimated if not ignored. They offer an exciting opportunity for the future of nurse educators and make mobile learning a reality and not as now a seemingly overwhelming obstacle. Their potential to bridge the gap between theory and practice, improve patient safety and reducing student anxiety is enormous and so far, it seems vastly underexploited both nationally and internationally.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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