



Experiences of undergraduate nursing students on an authentic mobile learning enactment at a higher education institution in South Africa



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ABSTRACT

Background: Mobile technology has infiltrated our day to day existence through provision of inexhaustible access to communication and information. In education, mobile devices are not only used as tools to reinforce information, motivate and accentuate engagement, but it additionally enables the delivery of course content. The adoption of authentic technological innovations using the variety of distinguishing attributes available on mobile devices could potentially promote a mobile learning enactment.

Objective: The purpose of the study was to explore the experiences of undergraduate nursing students who participated in an authentic mobile learning enactment aimed at enhancing their learning experiences.

Design: This study used a qualitative contextual design.

Setting and Participants: Undergraduate nursing students, of a School of Nursing in a Faculty of Community and Health Sciences at a university in South Africa, were the study participants. All students (n = 101) registered for the primary care and clinical skills module were invited to submit reflections based on their experiences on an authentic mobile learning enactment using WhatsApp Messenger.

Method: Students submitted electronic reflections after every two-week cycle of the enactment. The data collected was categorised into emerging themes as analysed by the researcher guided by Tesch's (1990) systematic process. An independent coder reviewed the data and, through consensus, themes identified were confirmed.

Results: One hundred and one participants (n = 101; 100%) submitted online reflections on their experiences during the authentic mobile learning enactment. Seven themes were identified which included: mobile devices afforded a learning platform; mobile learning enactment enhanced engagement; learning within a group made learning easier; flexibility in time allocated to complete tasks; challenges experienced with data/airtime/Wi-Fi; impaired communication due to poor network access and use of mobile devices in practice perceived as unprofessional.

Conclusion: The study provided valuable insights into students' experiences of the authentic mobile learning enactment, as well as suggesting ways to enhance the effectiveness of such an enactment.

1. Introduction

Mobile devices such as smart phones offer a variety of distinguishing attributes including individualized interfaces, in-time access to information, context sensitivity, instant communication and feedback that can be used to promote mobile learning enactments for nursing students (Sung et al., 2016). Mobile-learning (m-learning) has been defined as “the processes of coming to know through conversations across multiple contexts among people and personal interactive technologies” (Sharples et al., 2007:224). Muñoz-Reyes (2014) identified a number of features of mobile devices that contribute to make learning

“fun, satisfying and rewarding”. Some of these features or affordances include the portability of the mobile device due its size as some devices fit into the palm of your hand; it is user-friendly as it is possible for anyone to learn how to use the basic functions of the device, it is durable as some devices are shock resistant and it is dust and maintenance free, only needing to recharge the battery (www.wise-qatar.org).

In this contemporary era of technological advancements it is evident that all areas of society have been influenced by the technological advancements (Silva et al., 2017). The use of technology has expanded into teaching and learning in higher education institutions, including

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health sciences which allows for the development of new teaching and learning models (Silva et al., 2017). WhatsApp Messenger, a free application for smartphones, has been found to be beneficial for learning between students, other students, and educators with an increased student participation in both face-to-face and in a distant context (Johnson et al., 2015; Makoe, 2012; Nicholson, 2002; Rambe and Bere, 2013).

Sharples et al. (2016) specify that some basic principles of teaching and learning survived in the midst of the implementation of various forms of innovative technological interventions. It is important to acknowledge that the teacher is still central in education, but there has been a shift from providing information (“spoon feeding”) to facilitation or discussion and reflection to develop the critical thinking skills of learners (Sharples et al., 2016). The authors' further guide on the importance that students should remain responsible and goal-orientated while engaging with innovative pedagogical learning practices with the increased use of technological innovations (Sharples et al., 2016).

Willemse and Bozalek (2015) identified a challenge in the development of critical thinking skills in clinical learning environments in the undergraduate nursing students at a higher education institution in South Africa. Students experienced difficulty in “carting” clinical module guides and textbooks from an academic stimulating environment into a “restricted” hygienically clean or sterile clinical environment to continue their learning process. Hence the need identified to develop and implement an innovative authentic mobile learning enactment to support students to acquire the necessary clinical competence grounded on a firm theoretical foundation (Willemse and Bozalek, 2015). The primary and clinical care module in third year of nurse training at a university was selected to implement the study. This module is based on a comprehensive primary health care approach that focuses on the well-being of the individual and communities. It promotes healthier lifestyles, the prevention of diseases and the rehabilitation of people after an injury or illness.

2. Background

2.1. Technological Developments in Higher Education

Advancements in digital technology could improve access to health information in a global network of available information (Watkins et al., 2018). At the discussion discussions of 78 experts to produce the NMC Horizon Report: 2017 Higher Education Edition, in partnership with the Educause Learning Initiative, two questions were posed:

- Which trends and technology developments will drive educational change?
- What are the critical challenges and how can we strategize solutions?

Mobile learning was emphasised as essential for the future of education (Adams Becker et al., 2017).

The attitudes of students and their educators towards the use of mobile technology in teaching and learning play an imperative role in their willingness to use mobile devices for teaching and learning (Adov et al., 2017). The increased use of mobile learning technology enhanced participatory learning thus permitting students to discover and share significant experiences related to their learning (Wilson, 2013).

A mobile learning enactment (for the purposes of this study), was needed to bring about educational changes and to find solutions in a nursing module such as the primary care and clinical skills module that incorporates the health assessment. The focus of this study was to explore the experiences of nursing students on an authentic mobile learning enactment aimed to enhance their learning experiences thus developing their critical thinking skills in clinical learning environments.

2.2. Mobile Technology in Higher Education

There has been a substantial surge in the use of mobile technology, e.g. smartphones, in higher education to improve communication and engagement between students and educators (Chari, 2018). Mobile technology is applied in a diverse context for a variety of teaching and learning purposes including the establishment of discussion forums and distribution of content (Conejar and Kim, 2014). It was established that 86% of students own a smartphone and half of that percentage own a tablet (Johnson et al., 2014). The rapid innovative developments in medical technology enable the storage of information on mobile devices which in turn facilitates conducting research for detailed clinical knowledge on health-related conditions (Vivekanantham and Ravindran, 2014).

2.3. Student Views on Learning Using Mobile Devices

A review on students' perceptions on learning with mobile tablets established that mobile technology supported collaborative learning environments, which created an opportunity for students to discuss concepts, debate questions and to collaboratively build knowledge (Rossing et al., 2012). Hashim et al. (2015) found that the influence of motivational determinants indicated that students' intention to agree to an m-learning initiative was because if social, affective and cognitive needs. It was ascertained that students, as mature learners, have a strong inclination to accept m-learning interventions to enhance their learning. Dimond et al. (2016) identified that there is definitely more to be learned on the use of mobile technologies in clinical practice, how enactment rules are decided upon and the manner to enact with mobile technology within the health care environment.

2.4. Authentic Mobile Learning Enactment

The design of authentic learning experiences has the ability to promote the development of knowledge and skill in a real life setting. This could improve students' understanding of the relationship between the learning environments in relation to the challenges of their broader communities (Herrington and Oliver, 2000). Mobile learning facilitates the development of authentic learning spaces demonstrating that learning can take place through students' management of real-world problems and involvement in relevant projects that captures their interest (Traxler, 2007; Valk et al., 2010). Mobile devices support students to adapt to the transfer of information and the access thereof, in order to construct skills and knowledge, thus improving educational success (Valk et al., 2010). Nine characteristics of the authentic learning design principles are illustrated in Table 1 below.

An authentic learning approach could potentially create learning opportunities for students and educators from which they could benefit and draw upon once they physically leave the learning institution (Herrington et al., 2010). An engagement in innovative and more realistic tasks by students and educators could afford opportunities for compound collective activities for authentic learning to take place, supported by guidance and resources (Herrington et al., 2010).

Table 1

Characteristics of authentic learning principles.

(Adapted from Herrington and Oliver, 2000.)

- | | |
|----|---|
| 1. | Authentic contexts that reflect the way the knowledge will be used in real-life |
| 2. | Authentic activities that are complex, ill-defined problems and investigations |
| 3. | Access to expert performances enabling modelling of processes |
| 4. | Multiple roles and perspectives providing alternative solution pathways |
| 5. | Collaboration allowing for the social construction of knowledge |
| 6. | Opportunities for reflection involving metacognition |
| 7. | Opportunities for articulation to enable tacit knowledge to be made explicit |
| 8. | Coaching and scaffolding by the teacher at critical times |
| 9. | Authentic assessment that reflect the way knowledge is assessed in real life |

2.5. Mobile Messaging Tool: WhatsApp Messenger

With the low cost of emerging technologies, such as the WhatsApp Messenger application on mobile devices, the use of post-Web 2.0 tools and experimentation and discovery in teaching and learning have increased (Pacansky-Brock, 2017). Barhoumi (2015) identified the value in the implementation of a collaborative and whole class learning activity designed to provide opportunities for students to share their knowledge and experiences through discussion and comments using WhatsApp Messenger. Gon and Rawekar (2017) summarised that WhatsApp Messenger works across multiple platforms and is widely used among undergraduate students to send multimedia messages including photos, videos, audios and simple text messages. Due to its affordability and popularity, WhatsApp Messenger was identified to be used for the authentic mobile learning enactment. The authentic activities were designed to involve students in lifelike and significant tasks to enhance their learning, but ensuring that it was related to the outcomes of the primary care and clinical skills module.

3. Methods

3.1. Design and Participants

This study was a qualitative contextual study. In the study undergraduate nursing students at a school of nursing in a Faculty of Community and Health Sciences registered for the 2016 first semester primary care and clinical skills module participated in a mobile learning intervention. This intervention was followed by a qualitative contextual evaluation reflecting on their experiences on an authentic mobile learning enactment.

The population of the study included an “accessible” population (Burns and Grove, 2017; Teddlie and Tashakkori, 2009) of 114 third-year nursing students as part of a four-year Bachelor's degree who were enrolled in the ENT health assessment of the primary care and clinical skills semester module who were in possession of a mobile device. The accessible population who volunteered to participate in the study was a total of one hundred and one (N = 101) students.

3.2. Data Collection

Descriptive qualitative data in the form of electronic reflections was submitted by participants at the end of every iterative cycle during the authentic mobile learning enactment. Electronic reflections were submitted by students (n = 101) at the end of every of the three iterative cycles. The qualitative data were obtained from the open-ended question: “How did you experience the mobile learning enactment?”

3.3. Data Analysis

The systematic data analysis of the electronic reflections submitted was completed using an excel spreadsheet guided by Tesch's (1990) data analysis method (Creswell, 2014). The data collected were thematically analysed to develop the themes in an inductive approach, directed by the content (Braun and Clarke, 2006). Seven themes were identified from the electronic reflections received from the participants on their experiences on an authentic mobile learning enactment. Based on the findings, the following databases were searched to support the findings: EBSCOhost, SpringerLink, MEDLINE (Medical Literature Online), Academic Search Premier, Nexus, CINAHL (Computer Index to Nursing and Allied Health Literature), Science Direct, Scopus, Google, Google Scholar and the library resources. The keywords that were used included: mobile learning, mobile devices, undergraduate, nursing, students, authentic learning, teaching and learning, higher education and WhatsApp Messenger. The literature searched was collected, assimilated and integrated into the findings and discussions from the data analysis.

3.4. Ethical Considerations

Prior to the authentic mobile learning enactment institutional approval (12/10/16) and approval from the students were obtained at the higher education institution in the Western Cape Province, South Africa where the research was conducted. An information session was arranged on the premises of the university, where students were provided with both verbal and written information on the study. Student participants were informed that they could pull out from the study at any time without any penalty to their studies. Consent was obtained from students to use their mobile device contact number during the period of the enactment of the study.

Adhering to the principle of justice links to all information shared with the study participants were made available on the e-teaching platform of the HEI. All students registered for the 2016 first semester primary care and clinical skills module in the third-year of the undergraduate community health nursing program had to complete an ENT health assessment. All students were also able to access the information. This was done to ensure that every student who did not participate in this research study were not disadvantaged in the development of their clinical abilities through integration of theory and clinical practice. A total of thirteen (N = 13) students did not participate in the study due to a lack of access to a smartphone.

3.5. Planning the Authentic Mobile Learning Enactment

After consultation with experts in the field of primary health care, three sections of the module were selected for the study, which included the ear, nose and sinuses, and mouth and throat as indicated in Table 2 below.

In the primary care and clinical skills semester module, students had to attain the following main outcomes at a primary level of care:

- Demonstrate an understanding of conducting a history taking, specific to certain systems of the body
- Demonstrate an understanding of the techniques involved of conducting a physical assessment
- Demonstrate the ability to identify the difference between normal and abnormal conditions
- Demonstrate an understanding of the management objectives for common conditions

This study applied three iterative cycles during the mobile learning enactment which included a theoretical and clinical component. Each iterative cycle started with a theory session in class before students went into their clinical placement facilities. Each of the iterations was completed over a two week period through engagement with students to enhance their learning experiences using WhatsApp Messenger as a mode of communication.

Table 2
Planning of the three iterative cycles.

Week	Session	Health assessment
First iterative cycle		
1.	Theory session	Ear
2.	Clinical practice for 2 days	Ear
Second iterative cycle		
3.	Theory session	Nose & sinuses
4.	Clinical practice for 2 days	Nose & sinuses
Third iterative cycle		
5.	Theory session	Mouth & throat
6.	Clinical practice for 2 days	Mouth & throat

Table 3
Nine (9) principles of authentic learning applied.

No	Authentic learning elements	Evidence of how they were implemented
1.	Create authentic contexts that reflect the way the knowledge will be used in real-life	Interactive learning activities related to the health assessment in the primary care and clinical skills semester module were prepared and communicated to students using an online platform accessible on their mobile devices.
2.	Provide authentic activities	While within clinical practice, a task related to their prior theory class session on the health assessment in the primary care and clinical skills semester module was communicated to students. The responses could be used for class discussion or as study material for assessment purposes.
3.	Provide access to expert performances enabling modelling of the processes	A case-based scenario related to the health assessment was provided with guiding questions to model the expected responses required.
4.	Provide several roles and viewpoints	Students were encouraged to relate their answer on the case-based scenario to an actual or “real” case that was managed within the clinical facility. They were allowed to search the internet for resources if it was required, especially for case related pictures.
5.	Support collaborative learning allowing social construction of knowledge	Students were required to have a group discussion on their answers to the activities communicated, using the online mobile learning method while in clinical practice before submitting their responses.
6.	Create opportunities for reflection to enable critical reasoning	All participants were requested to submit weekly online reflections after each iteration via email based on their experiences.
7.	Create opportunities for articulation to enable tacit knowledge to be made explicit	This was facilitated with an analysis of the weekly online reflections, changes made as advised with every iteration.
8.	Provide coaching and scaffolding by the teacher at critical times	Scaffolding and coaching were used to communicate tasks on how to complete the online mobile learning activities were provided.
9.	Provide authentic assessment that reflect the way knowledge is assessed in real life	Students received feedback from their educators on the tasks completed and submitted related to the health assessment.

4. Design of the Enactment

4.1. Principles of Authentic Learning

The nine principles of authentic learning (Table 3), a constructivist philosophical approach to learning, prompted the implementation of an authentic mobile learning enactment with the purpose of enhancing the learning experiences of undergraduate nurses registered for the primary care and clinical module (Herrington and Herrington, 2006).

4.2. The Enactment: Three Iterative Cycles

Each of the iterations were completed over a two week period through engagement with students to enhance their learning experiences thus developing their critical thinking skills in clinical learning environments using WhatsApp Messenger as a mode of communication.

5. Results and Discussion

The themes identified included:

- mobile devices afforded a learning platform;
- mobile learning enactment enhanced engagement;
- learning within a group made learning easier;
- flexibility in time allocated to complete tasks;
- challenges experienced with data/airtime/Wi-Fi;
- impaired communication due to poor network access and
- use of mobile devices in practice perceived as unprofessional.

5.1. Theme 1: Mobile Devices Afforded a Learning Platform

Mobile devices promote mobile learning enactments as they offer a variety of distinguishing attributes that include personalised interfaces, in-time access to information, understanding the framework, immediate access to communication and responses (Sung et al., 2016). The participants viewed the online mobile learning enactment as “*innovative and it shows how social media can also be an educational platform*” to research and discuss challenges using WhatsApp Messenger with one another, as it “*created a new method of learning and communicating with students and with the health workers*”. It was established that the online mobile learning initiative created a platform for students to test their own knowledge and clinical abilities, thus motivating them to work harder:

I can say that it was interesting and also innovative and it shows how social media can also be an educational platform. And also, it was introducing something new for students that positive things can come out of social media ... It created a new method of learning and communicating ...

(Participant 2)

Students experienced the online mobile learning initiative as affordable and as an innovative educational platform that offered them a new method of learning, communication and a way to test their knowledge and clinical abilities.

5.2. Mobile Learning Enactment Enhanced Engagement

Mobile devices have become an expected and essential method of communication for students belonging to the Millennial or Net generation who value the daily use of technology. Most students have been found to have a web-capable mobile device that is able to send text messages and search web pages at any time during the day (Wilson, 2013). Increased use of m-learning technology provides a platform for engagement, taking active learning to new heights allowing students to explore and share meaningful learning experiences (Wilson, 2013). Participant 24 experienced mobile learning as a modern, informative and easily accessible method of communication that afforded a “*clear understanding on how to do an ear examination*”. Another participant responded as follows:

I loved the fact that it's quick and easy to use (referring to the WhatsApp Messenger application on the mobile device) and especially corresponding with each other. I also like the fact that it is a modern way of studying.

(Participant 37)

It can be concluded that mobile learning offers a new, contemporary way of learning using the latest technologies, e.g. using WhatsApp Messenger as a mode of communication (Fig. 1).

Students viewed the mobile learning platform using WhatsApp Messenger as informative and easily accessible. The enactment was perceived as “*innovative*” and students expressed that mobile applications can be used an educational platform to research and discuss challenges experienced. It was viewed that the mobile learning enactment “*created a new method of learning and communicating with students and with the health workers*”.



Fig. 1. WhatsApp Messenger as a mode of communication.

5.3. Learning Within a Group Made Learning Easier

A study by Barhoumi (2015) at a University in Saudi Arabia based on activity theory, indicated that there was value in the design and implementation of collective or group learning activities for the entire class to provide opportunities for students to share their knowledge and experiences among their peers.

In this authentic mobile learning initiative students were grouped according to the clinical placement facilities. Group norms were established and agreed upon prior to the enactment using WhatsApp Messenger. Setting group norms were important to ensure group cohesion.

This learning platform promote group learning which I do appreciate and enhance learning outside school settings.

(Participant 4)

Being able to communicate and get work completed without having to meet with the next person was an easy task.

(Participant 86)

Working together in a group made learning easier for students and they acknowledged that their learning was enhanced. The online mobile learning initiative enhanced communication between group members and students completed their tasks without face to face contact.

5.4. Flexibility in Time Allocated to Complete Tasks

Berry et al. (2016) reasoned that if the enactment is not acceptable to participants then they would be unlikely to participate in the enactment. It was thus important to measure the proposed and actual acceptability of an online mobile learning enactment. Martin (2016) suggested that context-based learning tools that include instructional technology such as videos, may offer various advantages in the development of students' knowledge regarding the phenomena under study.

Creating the video ... took up quite a bit of time in your day ... but it ended up being my favourite part of the entire forum.

(Participant 31)

Other problems we identified was that it took a lot of time out of the working day (approximately 3 hours) ...This was time we could have spent completing objectives and learning in the facility.

(Participant 91)

When a mistake is made it is frequently viewed in a negative manner, and fear can impact on the potentially positive contribution.

Evidence indicated that that dealing appropriately with mistakes made within the learning context by giving clear feedback and displaying tolerance with mistakes made, proved to be more effective than avoiding the situation (Keith and Frese, 2008).

Flexibility for completion and submission of tasks communicated have to be considered. Set time frames for completion and submission of tasks using WhatsApp Messenger caused frustration among students as they had certain outcomes related to their module to attain while they were in clinical practice. Video production proved to be challenging, as students attempted to produce a "perfect" video which was time consuming. It should be reinforced with students that any video produced, "perfect or imperfect", could be used as an educational tool to guide and correct clinical practice.

5.5. Challenges Experienced With Data/Airtime/Wi-Fi

Smartphones have brought mobile devices into the palms of students' hands, guaranteeing Internet access almost anywhere and any-time (Liebenberg et al., 2012). The authors identified the importance of creating an awareness regarding the affordability constraints with internet access within a South African context when planning the innovative technological use of mobile devices for educational commitments. Students may have access to the internet on their mobile devices for personal activities and be willing to pay for this usage, but this practice may not be acceptable to engage in learning activities (Liebenberg et al., 2012).

Students experienced challenges with internet connection while at clinical facilities related to their lack of personal availability of data to submit videos produced.

There is only one downside to the whole electronic-learning process is data usage. We are in this generation of technology ... if facilities ... could have Wi-Fi in facilities, it would make all of our work easier.

(Participant 3)

...making the video was an issue because it took a lot of data ...

(Participant 17)

When we tried submitting our data ran out and had to make alternative arrangements for submission.

(Participant 22)

Students identified the importance of ensuring network coverage and free Wi-Fi at clinical facilities for this "generation of technology" to ensure their ability to submit tasks while participating in a mobile learning project. Students should be permitted to submit the video

created after hours when they are back at the university residence or at home or at a public facility where they have free internet access.

5.6. Impaired Communication Due to Poor Network Access

Access to broadband connectivity at public institutions of learning, including schools and higher education institutions, could impact the country's growth and international effectiveness (Khan, 2015). Study participants experienced problems with some of the functionalities of their personal mobile devices and with Internet signals (broadband), which impacted their ability to communicate.

At the facility where we were placed had some technical difficulties because the network coverage wasn't so nice there.

(Participant 4)

We experienced signal problems at work and not everyone had data so it caused somewhat confusion and chaos.

(Participant 21)

Also at some clinics the network is very poor so that impairs the communication process and sometimes inhibit us from getting the necessary information.

(Participant 37)

Broadband connections of participants, with their Internet service providers, were problematic to some participants, while others had difficulties with insufficient data. Where possible data should be provided to students to allow continuation in their learning process. Good network coverage and access to free Wi-Fi are important components of the success of a mobile learning initiative.

5.7. Use of Mobile Devices in Practice Perceived as Unprofessional

In a study by Dimond et al. (2016) junior doctors voiced their concern regarding the use of mobile devices while working with patients and ward personnel. A lack of understanding on the effective use of smartphones and the associated professional etiquette within the hospital environment resulted in a hindered theoretical model of research including the distribution of information (Dimond et al., 2016).

Nursing personnel at clinical facilities where students were placed viewed the mobile learning enactment as an inconvenience and was "frowned upon".

It did serve as an inconvenience during my working hours as most since mobile device usage is frowned upon during our hours at the clinic.

(Participant 23)

Nursing personnel at the clinical facilities could not comprehend that a mobile learning could enhance student learning as it was not an accepted practice.

Sisters (registered nurses) couldn't understand why we using our phones (mobile device) while working.

(Participant 78)

Nursing practice is evidence-based and it would be important to prepare management and nursing personnel at clinical facilities on the use of smartphones as a resource for a mobile learning enactment (George et al., 2017).

6. Conclusion

The authentic mobile learning enactment with undergraduate nursing students demonstrated that activities communicated using mobile devices made sharing of information "easier" for students. An improvement to the enactment was made after every iterative cycle as guided by the responses received. WhatsApp Messenger provided students with an easy-to-use, fast and open line of communication with

their peers and educators that was viewed as a time saver. The enactment was viewed as a "fun", "very insightful" and "mentally stimulating" learning platform.

Access to free Wi-Fi 24 is important for students as they experienced challenges with internet access off campus. Flexibility allowed for the completion of tasks is key to success in a mobile learning enactment. It was evident that mobile devices had the potential to facilitate a new era of learning allowing "in-time" communication of activities and responses on the activities from students; submission of videos portraying clinical examination skills. The social space enhanced peer support and group cohesion and promoted learning.

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References

- Adams Becker, S., Cummins, M., Davis, A., Freeman, A., Hall Giesinger, C., Ananthanarayanan, V., 2017. NMC horizon report. Higher education edition. The New Media Consortium, Austin, Texas <https://www.nmc.org/publication/nmc-horizon-report-2017-higher-education-edition/>.
- Adov, L., Must, O., Pedaste, M., 2017. Attitudes towards mobile devices in Estonian basic education: using the framework of the UTAUT model. In: Zaphiris, P., Ioannou, A. (Eds.), *Learning and Collaboration Technologies. Technology in Education. LCT 2017. Lecture Notes in Computer Science*, 10296 Springer, Cham, Switzerland.
- Barhouri, C., 2015. The effectiveness of WhatsApp mobile learning activities guided by activity theory on students' knowledge management. *Contemp. Educ. Technol.* 6 (3), 221–238.
- Berry, N., Lobban, F., Emsley, R., Bucci, S., 2016. Acceptability of enactments delivered online and through mobile phones for people who experience severe mental health problems: a systematic review. *J. Med. Internet Res.* 18 (5), e121. <https://doi.org/10.2196/jmir.5250>.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qual. Res. Psychol.* 3 (2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>.
- Burns, N., Grove, S.K., 2017. *The Practice of Nursing Research: Appraisal, Synthesis, and Generation of Research Evidence*, 8th ed. Elsevier, St. Louis, MO.
- Chari, V., 2018. Five ways higher education is making use of mobile technology. <http://blog.fullfabric.com/five-ways-higher-education-is-making-use-of-mobile-technology>.
- Conejar, R.J., Kim, H.K., 2014. The effect of the future mobile learning: current state and future opportunities. *Int. J. Softw. Eng. Appl.* 8 (8), 193–200.
- Creswell, J.W., 2014. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 4th edition. Sage Publications, California.
- Dimond, R., Bullock, A., Lovatt, J., Stacey, M., 2016. Mobile learning devices in the workplace: 'as much a part of the junior doctors' kit as a stethoscope?' *BMC Med. Educ.* 16, 1–9. <https://doi.org/10.1186/s12909-016-0732-z>.
- George, T.P., DeCristofaro, C., Murphy, P.F., Sims, A., 2017. Student perceptions and acceptance of mobile technology in an undergraduate nursing program. *Healthcare* 5 (35), 2–8.
- Gon, S., Rawekar, A., 2017. Effectivity of E-learning through WhatsApp as a teaching learning tool. *MVP J. Med. Sci.* 4 (1), 19–25.
- Hashim, K.F., Tan, F.B., Rashid, A., 2015. Adult learners' intention to adopt mobile learning: a motivational perspective. *Br. J. Educ. Technol.* 46, 381–390. <https://doi.org/10.1111/bjet.12148>.
- Herrington, A., Herrington, J., 2006. *Authentic Learning Environments in Higher Education*. Information Science Publishing, Hershey, Pennsylvania. <https://doi.org/10.4018/978-1-59140-594-8>.
- Herrington, J., Oliver, R., 2000. An instructional design framework for authentic learning environments. *Educ. Technol. Res. Dev.* 48 (3), 23–48.
- Herrington, J., Reeves, T.C., Oliver, R., 2010. *A Guide to Authentic e-Learning*. Routledge Taylor & Francis Group, New York.
- Johnson, L., Adams Becker, S., Estrada, V., Freeman, A., 2014. *NMC Horizon Report: 2014 Higher Education Edition*. The New Media Consortium, Austin, Texas.
- Johnson, L., Adams-Becker, S., Estrada, V., Freeman, A., 2015. *NMC Horizon Report: 2015 Higher Education Edition*. The New Media Consortium, Austin, Texas.
- Keith, N., Frese, M., 2008. Effectiveness of error management training: a meta-analysis. *J. Appl. Psychol.* 93 (1), 59–69.
- Khan, S., 2015. South Africa's national broadband policy purpose-SA connect. Retrieved from https://researchafrica.net/presentations/Presentations/2015%20Khan_Safia_ITU%20Broadband%20Policy%20Presentation.pdf.
- Liebenberg, H., Chetty, Y., Prinsloo, P., 2012. Student access to and skills in using technology in an open and distance learning context. *Int. Rev. Res. Open Dist. Learn.* 13 (4), 250–268.
- Makoe, M., 2012. Teaching digital natives: identifying competencies for mobile learning facilitators in distance education. *S. Afr. J. High. Educ.* 26 (1), 91–104.
- Martin, A., 2016. Assessing the effect of constructivist YouTube video instruction in the spatial information sciences on student engagement and learning outcomes. *Ir. J. Acad. Pract.* 5 (1), 9. <http://arrow.dit.ie/ijap/vol5/iss1/9>.
- Muñoz-Reyes, C., 2014. Bridging the digital and knowledge gap in rural communities

- through mobile learning. <http://www.wise-qatar.org/mobile-learning-rural-communities>.
- Nicholson, S., 2002. Socialization in the “virtual hallway”: instant messaging in the asynchronous web-based distance education classroom. *Internet High. Educ.* 5 (4), 363–372.
- Pacansky-Brock, M., 2017. Five invisible barriers preventing change in higher education. <https://www.edsurge.com/news/2017-04-28-5-invisible-barriers-preventing-change-in-higher-ed>.
- Rambe, P., Bere, A., 2013. Using mobile instant messaging to leverage learner participation and transform pedagogy at a South African University of Technology. *Br. J. Educ. Technol.* 44 (4), 544–561.
- Rossing, J.P., Miller, W.M., Cecil, A.K., Stamper, S.E., 2012. *J. Scholarsh. Teach. Learn.* 12 (2), 1–16.
- Sharples, M., Taylor, J., Vavoula, G., 2007. A theory of learning for the mobile age. In: Andrews, R., Haythornthwaite, C. (Eds.), *The Sage Handbook of E-learning Research*. SAGE Publishers, London, pp. 221–247.
- Sharples, M., de Roock, R., Ferguson, R., Gaved, M., Herodotou, C., Koh, E., Kukulskahulme, A., Looi, C.K., McAndrew, P., Rienties, B., Weller, M., 2016. *Innovating Pedagogy 2016: Open University Innovation Report 5*. Institute of Educational Technology. The Open University.
- Silva, H.S., Bariani, R.C., Kubo, H., Leal, T.P., Ilinsky, R., Borges, T., Faltin, K., Ortolani, C.L.F., 2017. The use of technologies for teaching dentistry in Brazil: reflections from an integrative review. *Int. Educ. Stud.* 10 (4), 172–178.
- Sung, T., Chang, K., Liu, T., 2016. The effects of integrating mobile devices with teaching and learning on students' learning performance: a meta-analysis and research synthesis. *Comput. Educ.* 94, 252–275.
- Teddlie, C., Tashakkori, A., 2009. *Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioral Sciences*. SAGE Publications, Thousand Oaks, California.
- Tesch, R., 1990. *Qualitative Analysis: Analysis Types and Software Tools*. Falmer Press, London.
- Traxler, J., 2007. Defining, discussing and evaluating M-learning: the moving finger writes and having writ.... *Int. Rev. Open Res. Dist. Learn.* 8 (2), 1–12.
- Valk, J.H., Rashid, A.T., Elder, L., 2010. Using mobile phones to improve educational outcomes: an analysis of evidence from Asia. *Int. Rev. Res. Open Dist. Learn.* 11 (1), 117–140.
- Vivekanantham, S., Ravindran, R.P., 2014. Improving the medical student experience using electronic timetabling. *Adv. Med. Educ. Pract.* 5, 213–214.
- Watkins, A., Goudge, J., Gómez-Olivé, F.X., Griffiths, F., 2018. Mobile phone use among patients and health workers to enhance primary healthcare: a qualitative study. *Soc. Sci. Med.* 198, 139–147.
- Willemse, J.J., Bozalek, V., 2015. Exploration of the affordances of mobile devices in integrating theory and clinical practice in an undergraduate nursing programme. *Curatoris* 38 (2), 1510. <https://doi.org/10.4102/curatoris.v38i2.1510>. (10 pages).
- Wilson, M., 2013. Mobile learning: endless possibilities for allied health educators. *J. Diagn. Med. Sonogr.* 29 (5), 220–224.