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Exploring Nursing Students' Perceptions of their Learning Experience in a Gerontological Nursing Course with a Technology-Mediated Learning Environment

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ABSTRACT

This was a multi-method study employing pre- and post-course questionnaires and focus groups to explore nursing students learn ing experiences with a technology-mediated learning approach guided by the Substitution, Augmentation, Modification, and Redefinition (SAMR) model in the course Gerontological Nursing. 144 undergraduate nursing students completed the question
naires. The findings suggest that the students perceived a significant improvement in their cognitive skills, class atmosphere, and educational practices at the end of the course when compared to the baseline. However, no significant increase was found in their perceived engagement in technology-mediated activities. Five themes emerged from three focus groups involving 17 students: Beneficial to my learning, feeling less stressed, motivating me to learn, Feeling more engaged, and Encountering some technical barriers and suggestions for improvement. Students' perceptions of using technologies for teaching and learning were mostly posi tive. Digitalised teaching materials should be interactive and locally relevant to improve students' learning experience and engagement.

Introduction

Many university students have had significant exposure to information technology since a young age (McMillan & Morrison, 2006). However, much of this exposure relates more to entertainment than to learning. Digital literacy involves an ability to effectively use technology to identify reliable information and to correctly interpret and use it to solve problems (Prior et al., 2016). To equip future nurses to be digitally literate is essential to meet the increased demands from the technological revolution in health care settings (World Economic Forum, 2018). Therefore, nurse training should include learning experi ences with information technology as an integral part of the learning experience.

Apart from developing digital literacy, what is most important in a technology mediated learning environment is improving the positive learning experiences of stu dents by enhancing their engagement and interactions with teachers and peers. This is particularly the case when the teaching takes place in a large class. Technology-mediated learning refers to an environment in which the students' interactions with learning materials, peers, and teachers are mediated through technologies such as computers, telecommunication, online open educational resources, multimedia, multiple audio-visual sources, and learning management systems (Alavi & Leidner, 2001; Zwart et al., 2017).

The use of technology-mediated learning in nursing education has focussed largely on online learning, which refers mainly about web-based learning and requires students to use a connected device to access to learning and teaching activities (Button et al., 2014; QAA, 2020). The utilisation of technologies in this study referred to it in combination with face-to-face classroom teaching is

an approach that is still under development for university teachers and students, and its effectiveness remains unclear (Hao, 2016).

A few studies have been conducted on the impacts of technology-enhanced learning in classroom settings on student learning, but the results have been mixed as to whether such learning is more effective than traditional classroom teaching (Geng et al., 2019). When integrated in the classroom, technology can offer rapid feedback on performance and improve student engagement. For example, the use of an audience response system (ARS) such as Kahoot or clicker with immediate feedback increased student engagement and led to significantly higher scores for the intervention than for the no-ARS control (Lantz & Stawiski, 2014). However, most studies have focussed on a specific type of technology used in classroom teaching, such as ARS, rather than regarding technology as an integral part of the learning environment and evaluating its effects using a theory driven approach (Webb et al., 2017).

In conclusion, there have been limited studies on the effects of a theory-driven, technology-mediated learning environment on the learning experience of nursing stu dents. The aim of this study, therefore, was to explore the learning experiences of undergraduate nursing students in such an environment in a nursing course called Gerontological Nursing.

Research approach

Study aims and design

A multi-method design that included pre- and post-tests (i.e., quantitative research using a questionnaire) and focus groups (i.e., qualitative research) was employed to

address the following research question: What will be the learning experiences of undergraduate nursing students in a theory-driven, technology-mediated learning environment adopted in a nursing course?

Theoretical framework guiding the development of the technology-mediated learning environment

When incorporating technology into teaching, the process should emphasise the design ing and planning of a technology-mediated learning environment that ensures the achievement of the learning objectives (Tuparov et al., 2004). Linking pedagogy and technology to deliver education is essential to enhancing the learning experiences of students (Casey et al., 2017). A review has shown that Puentedura's *Substitution, Augmentation, Modification, and Redefinition* (SAMR) model can lead to better learning outcomes for secondary school students, with effect sizes ranging from 0.029 to 1.563, and that using technology to develop teaching at a higher level of the framework (e.g. redefinition) yields a larger effect (Hamilton et al., 2016). Therefore, this model was adopted as the theoretical framework guiding the development of the technology mediated learning environment (Table 1).

The learning objective of this 13-week course called Gerontological Nursing was to develop the students' professional knowledge and skills in identifying the health needs of older people, and in planning and implementing holistic nursing care for older people and their caregivers in various healthcare settings. The SAMR model was used as a framework to develop the pedagogies for the technology-mediated learning activities in this subject (Puentedura, 2012).

The implementation of SAMR model-guided technology-mediated learning activities

In this course, students were encouraged to study the pre-lecture online study materials at home. Online multiple-choice questions were adopted for students to self-evaluate their level of understanding of the pre-class learning materials. As these online study materials were only substitutes for traditional textbooks and notes, we regarded them as falling under the dimension of substitution.

In the augmentation dimension, all of the teachers involved in the course replaced the traditional PowerPoint lecture with multi-touch e-books/educational apps accessed using an iPad. Students were also recommended to download the same e-books/education apps on their own smartphones or tablets. Both teachers and students could access the same e-books/apps to engage in interactive game-based teaching activities during the lectures. If necessary, the screen of the students' tablets could be easily displayed to the whole class via Apply TV. When compared with PowerPoint (which involves the use of a keyboard and mouse), the multi-touch environment is more flexible because animations and videos can be shown to students during lectures. Relevant information from multimedia sources can be more easily incorporated into lectures using an iPad and Apple TV than with traditional PowerPoint slides. Students are not only able to passively read and listen to the teacher's explanation on the PowerPoint slides but can also be stimulated and engaged by different multimedia sources.

In the modification dimension, an in-class group discussion based on a case study was conducted during the lectures. Searching online for information was permitted during the discussion. All of the groups were required to prioritise

their evidence-based nursing interventions based on their analyses of the case. A conventional classroom with a single audio-visual (AV) source/screen can only allow to show one AV output at a time. With the newly built-in multiple AV sources/screens, as many as six different AV outputs (such as instruction slides from teachers, online search engines, care plans from presentation groups, and peer feedback) can be shown at the same time. Due to time constraints, two groups were usually invited to share their care plan with the whole class simultaneously on the screens. A couple of students were invited to give verbal comments on various plans. The remaining students were required to post their feedback through the learning management system, which was shown immediately to the whole class during the lectures. This process facilitated intra- and inter-group discussions in a classroom with more than 150 students. This provision of peer feedback through multiple approaches (verbal and written) during the class further engaged the students. In the redefining dimension, we encouraged the students to become engaged by using their smartphones to participate in the online formative quizzes and activities during class. Their overall response rates to different questions were shown on the screen to the whole class. An analysis of the items was conducted after the quiz. Should common misunderstandings of a particular concept be identified based on the item analysis, the teachers were able to immediately reinforce the correct concepts. Such teacher–student interactions would not have been possible without technology-mediated learning.

Sample and setting

The study was conducted at a school of nursing in a government-funded university in Hong Kong. Data were collected from September to November 2018 from a convenience sample of 144 undergraduate year III nursing students who were enrolled in the course. All students enter the undergraduate nursing programmes at the age of 18 after a university entrance public examination. There were no mature students (≥ 25 years) in this study population.

Procedure and ethical considerations

Ethical approval was obtained from the Human Subjects Ethics Review Committee of the university (HSEARS 20170821002). All students (N = 156) enrolled in this course were informed of the aim of the study during the first lecture. Their participation was voluntary, and they could withdraw at any time with no effect on their studies. They were given assurances of anonymity and confidentiality. Students who gave their informed consent to join the study received an online questionnaire through email after the first and last lectures. Convenience sampling was adopted to recruit students to take part in focus groups, which were conducted 1 week after the last lecture by a research assistant (RA) with experience in a similar research study.

Data analysis

Quantitative research: The aim of implementing a technology-mediated teaching environment was to promote positive learning experiences among the students, including engagement, cognitive skills, educational practices, and class atmosphere. The 36 item Classroom Survey of Student Engagement (CLASSE) questionnaire – student version was used to evaluate the learning experiences of the participating students who took part in this study (Ouimet & Smallwood, 2005). This questionnaire reflects their learning experience in four domains:

● ‘Engagement activities’ evaluated a student’s level of engagement in various teaching and learning activities.

● ‘Cognitive skills’ assessed a student’s self-perceived capability to retain, synthesise, and apply the learned knowledge.

● ‘Educational practices’ determined the time and effort that a student has spent in studying the course.

● ‘Class atmosphere’ assessed a student’s feeling of having a positive learning experience.

Each item was rated on a 4-point Likert scale ranging from 0 (Never/Rarely) to 3 (More than 5 times per week/Very often/Very much).

The quantitative data were analysed using the statistical package SPSS 24 for Windows. Descriptive statistics were used to summarise the characteristics of all participants: the frequency distribution for categorical data and means and standard deviations for continuous data. A dependent t-test was used to examine the difference between the pre and the post-course questionnaires. The level of significance was set at 0.05. The missing data were replaced with the mean values of the group.

Qualitative research: All focus groups were digitally audio-recorded and then transcribed by the RA. The transcribed texts were then analysed by employing the principles of qualitative content analysis (Graneheim & Lundman, 2004). To ensure credibility, two authors (JL and KW) attempted to identify the themes and their relevant quotations independently. The whole research team then discussed the themes that were identified until a consensus was reached.

Results

Quantitative findings

Participants

One hundred and fifty-six undergraduate year III nursing students were registered on the course; of these 144 consented to participate in this study (response rate: 92.3%). They were mainly female (75.5%) and taking this subject for the first time. One hundred and forty-four students completed the CLASSE questionnaire at baseline and 115 questionnaires were returned at the end of the semester (attrition rate: 20.1%).

Classroom questionnaires of the students' learning experience

The results of the dependent t-test showed a statistically significant improvement in cognitive skills ($t = 2.20$, $p = 0.029$); class atmosphere ($t = 2.36$, $p = 0.019$); and educational practices ($t = 2.61$, $p = 0.009$) at the end of the course when compared to the baseline. However, no significant improvement was found for engagement in activities ($t = -0.78$, $p = 0.938$) (Table 2).

Qualitative findings

Seventeen students were recruited to take part in three focus groups, with five to six in each group. Nine (52.9%) were female. The following five themes were identified: Beneficial to my learning, feeling less stressed, motivating me to learn, Feeling more engaged, and Encountering some technical barriers and suggestions for improvement.

(1) Beneficial to my learning

Students expressed appreciation for having different technology-mediated learning activities during the lectures through an audience response system (i.e., Kahoot) and

multiple audio-visual sources. They thought these activities gave them an immediate chance to test their understanding of the topic and their performance.

● The item analysis after each online MCQ quiz . . . made me realise my level when compared with the whole class.

● The lecturers' explanations after each question helped me a lot to understand difficult concepts, especially after I had given wrong answers in the in-class online quizzes. The approach allowed me not only to learn but to retain the newly learned information effectively.

Another student described her learning experience in a case study with a class group discussion and presentation.

● Those students who presented their case study to the whole class learnt the most, as the lecturers could comment on their care plan immediately. However, the whole class was still able to get involved by providing feedback via Blackboard (i.e., an online learning management system). I tried to compare my feedback with that given by the lecturers and other students. This was an effective way to improve my critical thinking and analytical skills.

(2) Motivating me to learn

As the students were continually provided with chances during the lectures to immediately apply their knowledge, they felt both challenged and motivated to learn:

● The students are required to immediately apply what they have learnt during the lectures to different in-class activities. Our responses could be displayed to the whole class in real time. It is like a competition. As you don't want to be left behind, you are motivated to pay attention to the contents of the teaching.

Students appreciated the alignment between the pre-lecture online homework and the in-class activities. After completing the homework, the students found it easy to understand the contents of the lectures.

● I prefer to spend time doing the pre-lecture online homework; otherwise, I would be unable to actively participate in different activities during the class. After the pre lecture preparation, I have some basic ideas about the upcoming lecture. I can then pay more attention to the difficult contents. It helps me to get the most out of the lectures.

(3) Feeling less stressed

Students also mentioned that they preferred to respond to the lecturers' questions through an online system, such as Kahoot or padlet, rather than face-to-face or through pen and paper:

● It feels less embarrassing to post my questions in real time on padlet (i.e., an online collaboration software using posts and comments) during the lectures. I did not need to interrupt the flow of the lecture. I also felt great when other students agreed that my questions were also relevant to them, and the lecturers addressed the questions immediately during the lecture.

(4) Feeling more engaged

With the technology, we designed in-class activities that could involve all 156 students and lecturers. In general, the students recognised that the interactive approach to teaching under the technology-mediated learning environment would benefit their learning by encouraging them to become more engaged.

● Kahoot is more interesting and interactive when compared to a traditional pen-and paper quiz. You can compare your answer with the answers of your classmates and become more aware of your standard compared to the whole class.

(5) Encountering some barriers and suggestions for improvement

The students gave some valuable feedback relating to technical barriers.

● I felt frustrated occasionally when I was unable to complete the online MCQ quiz due to my inability to access the Wi-Fi network. It would be good if we were allowed more time to connect to the webpage.

● I was unable to scan the QR code when I sat at the back of the lecture hall. Maybe the lecturers can include the QR code on the note.

Some students also made suggestions on teaching strategies, relating to improvements in ways of using technology to enhance their learning experience.

● Since we have a big class with more than 150 students, it was a bit too rushed to do the case study during the lecture. Maybe the lecturers could let us have the case in advance or integrate it in the pre-lecture homework.

● Some videos used for the pre-lecture study are different from local clinical practices. If possible, more local videos should be used, alongside the overseas videos.

Discussion

This study reported the process of integrating technology in a nursing course in which the pedagogies and technology-mediated learning were developed based on the SAMR model (Puentedura, 2012). In general, students' perceptions of adopting the technology-mediated learning environment in the course were mostly positive. As

seen from the qualitative findings, significantly higher scores were given after the completion of the course in three out of four domains, particularly in response to the questions asking the students about their ability to memorise, synthesise, and apply the knowledge and skills that they had learned. This is consistent with other studies suggesting that students had positive perceptions of an approach to teaching that makes use of technologies (Macznik et al., 2015; Noroozi et al., 2016).

With regard to the qualitative findings, the students acknowledged that the technologies had beneficial effects on their learning by facilitating thinking, reflection, and learning from multiple perspectives. Specifically, the majority liked the interactive in-class technology-mediated activities, which encouraged them to actively engage in various learning activities and reflect on their own learning process.

The technology-mediated learning environment facilitated the shift from a teacher oriented to a student-centred approach. Besides feeling less stressed when an anonymous approach was used to hold in-class quizzes, the real-time feedback and item analysis provided students with chances to evaluate their performance and benchmark it against that of the whole class. Students did not want to lag behind their classmates. Thus, they perceived that they had spent significantly more time and effort in studying for this course. In addition, the real-time feedback that the students gave after the online in class quizzes provided opportunities for the teachers to adjust the contents of their teaching (Plump & LaRosa, 2017).

Although students perceived that they had spent more time studying, the number of students who completed the pre-class study dropped by around 29% from weeks 1–13 of the course. This may indicate that the pre-class online materials should be better

aligned with the contents of the upcoming lectures. To address this limitation, the pre-class online materials should be carefully selected for relevance and applicability to local contexts. A study guide should be included for students to understand how the learning objectives of each lecture can be achieved by studying the pre-class online materials. That there were no consequences for not reading the pre-class materials may also have contributed to the drop in pre-class engagement towards the end of the course. In future, marks could be allocated to evaluate the students' performance in studying the pre-class teaching materials.

Students stated in the focus groups that they had become more engaged in a technology-mediated learning environment. However, no significant increase in the students' self-perceived engagement in different learning activities was found between the pre- and post-course questionnaires. This may indicate differences in levels of acceptance of a technology-mediated learning environment and active learning roles among individual students. Because levels of digital literacy varied among the students, some might still prefer traditional didactic lectures to the integration of technology in the learning process. Thus, it must be remembered that technology-mediated learning does not suit everyone (Petty, 2013). Moreover, simply digitalising the teaching materials may not be enough to enhance student engagement. Rather, it is necessary to focus on the processes of 'modification' and 'redefinition' under the SAMR model to develop pedagogies for the technology-mediated learning activities (Hamilton et al., 2016).

Feedback from the focus groups showed that some students were frustrated when they experienced difficulties with their internet connection during the lectures. The technical issues reinforce the need to anticipate and address potential hardware and software mismatches, and for multimedia resources to be available in different

formats. There must be regular testing of all multimedia resources, hardware, and software, including Wi-Fi access, to ensure that they work, and technical support must be made readily available to resolve issues promptly. These strategies will help to minimise student dissatisfaction, reduce stress, and prevent disruptions and disengagement from the learning process.

This study had several limitations. First, the study population was restricted to one undergraduate nursing cohort enrolled in a single university, thereby limiting the generalisability of the findings. Second, using a self-reported method may also have induced expectation bias. However, anonymity was adopted when conducting the questionnaires, which may have helped to minimise the bias. Third, the CLASSE questionnaire only underwent face validation by a team of educational experts. Fourth, no quantitative data were available to reflect the acceptability and usability to the students of each technology used in this study. Fifth, without a control for comparison, it is unclear whether the positive outcomes were purely based on this teaching innovation or due to Hawthorn or novelty effects. Finally, this study lacked objective instruments to measure the extent to which technology-mediated learning activities influenced the students' performance. Caution should therefore be exercised when interpreting the findings.

Conclusion

Technology-mediated learning allows teachers to enhance their traditional teaching mode with more engaging and interactive teaching methods. The SAMR model provides a framework for developing pedagogies through a technology-mediated learning environment that seemingly can enhance active and collaborative learning among students. This study showed that the students' perceptions of using

technologies for learning were mostly positive. Attention should be paid to designing online pre-class study materials with more interactive and locally relevant components to better align with other teaching and learning activities. The pre-class materials could also be linked to quizzes or the final examination to increase student engagement. Ensuring that all technologies, both hardware and software, are functioning normally would help to minimise student dissatisfaction and prevent disruptions and disengagement from the learning process. To further investigate the effects of the technology-mediated learning approach, a quasi-experimental or comparative design should be adopted in a future study to compare its effects of technology-mediated to other teaching approaches.

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