Integrating M-Learning in Teaching ECG Reading and Arrhythmia Management for Undergraduate Nursing Students

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Abstract—Use of mobile devices among nursing students is recently a widespread approach. Integrating mobile devices in education can improve the quality of nursing education by engaging students in learning experience. The present study aims at investigating the effect of using Mobile Learning (M-learning) on students' academic achievements and satisfaction. Therefore, quasi-experimental design was used. The study included 104 students who were enrolled in a critical care course at the faculty of Nursing. During the study, the participant were divided into control and experimental groups. The experimental group 52 students were able to use a developed mobile application, which includes learning materials and multimedia resources, dedicated to critical care course. On the other hand, control group 52 students were able to explore the classical learning materials form the course. The study included students' attitudes, students' satisfaction, and students' academic achievements. Differences between the two groups were considered significant as the result was $p < 0.05$. The obtained results showed significance difference between pre-post quizzes achievements between the experimental and control group ($p<0.000$). Additionally, 76% of the students were satisfied with using M-learning. The study revealed that there was improvement in the student academic achievements and satisfaction when integrating mobile learning into nursing education.

Keywords—M-learning, ECG, arrhythmia, nursing students

1   Introduction

Use of mobile devices for educational purposes among nursing students today is widespread trend. Evidences showed that integrating mobile devices can improve the quality of nursing education by engaging students in learning experience. Integration of Mobile learning (M-learning) in educational settings is an important issue for academic institutions and universities [1]. Also, global nursing education programs are experiencing the rapid changes according to recent technologies. In particular, the students are witnessing the exponential growth and power of mobile processing. Using mobile devices has become more commonplace, increasing the desire of students

to become more connected, and have instant access to knowledge anytime and any-where.

At the same time, there has been a rapid growth in the mobile technology including both the hardware and software. Furthermore, smartphones and tablets are considered more attractive for students. This is due to the fact that smartphones and tablets are portable and cheaper if they are compared with desktop PCs, and laptops [2]. This makes smartphones available and affordable for a wide range of students. Nowadays, most of the students are using smartphones on regular bases. With the widespread use of smartphones and tablets, researchers start investigating the use of such devices in different educational contexts [3]. Moreover, the recently improved hardware tech-nologies along with software applications make it possible to use mobile applications in educational contexts for a wide range of domains such as chemistry, physics, healthcare, medicine, etc.

Aforementioned aspects encourage researchers to examine the utilization of M-learning in education. Adoption of M-learning can improve students and teachers to adopt the mobile technology as a method of teaching and learning [4]. In particular, different research studies were conducted to investigate the healthcare and medical students' attitudes toward the use of M-learning during their bachelor study [5].

Concerning the advantages of using M-learning in HEIs for medical and healthcare studies, students can learn faster outside the class time by being able to access the internet, and the availability of wide range of online learning resources [6]. Further-more, using M-learning will be helpful specially for medical students as medical stud-ies is continuous and life-long [7]. M-learning promotes acquiring and sharing knowledge by enhancing the cognitive learning process and explaining their own understanding. The use of M-learning with social communication between the stu-dents improve interactive and collaborative learning [8]. Furthermore, M-learning applications can be provided with interaction means between different peers and classmates so that the students will be encouraged to ask questions, get feedback, provided with the required help in faster manner and discuss different learning topics [5]. Also, M-learning can be considered an added value if there are some learning concepts that need to be simulated, visualized in 3D aspects, or interacted with.

Evidenced from the result of previous studies indicates that university students demonstrated positive attitudes towards the use of technology. In addition, perceived utility and attitudes towards the use of technology predict the intentions of students to use M-learning [5, 9, 10]. Exploring M-learning perceptions of undergraduate stu-dents, Patil et al. (2016) found that 76.7 percent of students perceived M-learning as important [5].

In 2016, Al - Emran, Elsherif & Shaalan examined the attitudes of students and ed-ucators towards using M-learning in Oman and UAE higher education universities; two neighboring Arab Gulf countries. The results showed that M-learning can be one of the promising pedagogical technologies to be used in the Arab Gulf countries ' higher education environments [11].

Furthermore, Kim et al. (2017) examined the efficacy of mobile application by measuring the knowledge, skills and confidence of nursing students in simulated per-formance when providing care [12]. The study found that for the experimental group,

the scores on knowledge and satisfaction with the method of learning were higher than for the control group, although there was no significant difference.

Online universities have begun to accept mobile technology as a new learning tool; therefore, their acceptance has directly and indirectly influenced students' learning achievement [13]. However, minimal research attention has been directed toward the Palestinian students' attitudes, satisfaction and perception using M-learning in higher education. In general, smartphones are widely used among medical students who use them for various purposes, such as recording lectures, writing notes and communicating with their colleagues and instructors. Moreover, nursing faculty need more assistant on how to use and implement m-learning activities in classroom [1]. However, there was several attempts to propose different smart phones-based solutions and investigating students' readiness to use M-learning.

This article is useful for identifying and implementing strategies for adopting a new learning method [14, 15]. Therefore, the conducted research work provides useful details for ministries of higher education as it contributes suggested practices for policy makers in education in Palestine.

2   Methodology

This section explains the formulated research questions and objectives. After that an explanation about the developed mobile application that was used to answer the research questions and achieve the research objectives. Then, evaluation setup and ethical approval are explained in the following sections. Finally, explanation about the adopted questionnaire and interpretation are presented.

2.1   Research questions and research objectives

The purpose of this study was to investigate attitudes, perception and satisfaction of M-learning among nursing students enrolled in critical care course at a private university in Palestine. Therefore, the research questions were introduced to answer the following questions:

- What is the student's attitude towards using mobile learning in a critical care course?
- What is the student's satisfaction towards using mobile learning in a critical care course?
- What is the student's perception towards using mobile learning in a critical care course?
- Is there an improvement in academic achievements for the students who used m-learning application?
- What are the barriers for adopting m-learning from students' perspectives?

Accordingly, the research objectives of the current study were to:

- Assess nursing student's attitude toward integrating mobile learning in the critical care course
- Differentiate between quizzes achievements between control and experiment group
- Assess nursing satisfaction with the mobile learning
- Find the differences between the students' attitudes and perceptions in relation to some demographic information
- Identify the barriers that face M-learning integration from the viewpoint of nursing students at Arab American University in Palestine

2.2 Mobile application

In order to answer the previous questions, a dedicated mobile application was required as a first step. Therefore, the class teacher identified some important concepts that students experience difficulties to learn such as learn ECG analysis, arrhythmia interpretations and management. An Electrocardiogram (ECG) is a test used to detect the electrical activity of the heart and diagnose heart arrhythmias.

The developed mobile application enables the students to access learning materials related to the aforementioned learning concepts. It is important to clarify that the developed mobile application was not only used for investigating the students' attitudes, satisfaction and perception but also for investigating if there is an improvement in the academic achievements for those who use the mobile application alongside the classical course materials. This implies that there are different functionalities that are supported by the application. For instance, students are able to login into the mobile application and start exploring the different learning resources, submitting quizzes and exams, and exploring assessments results.

In more detail, the application is built according to the client/server model. The server side is web-based architecture and it allows the teacher to perform several tasks including the upload of learning materials, student names and ID numbers, quizzes questions and answers as well as collecting the result after the quiz is finished. On the client side, a mobile application is created with two distinct graphical user interfaces (GUI); one for the teacher and another for the students. The student version allows him to access the learning material any time anywhere. One important feature of the this version is the introduction of voice where he can listen to the learning material while he is on the move. Through it, the student will also take quizzes an experiment tests. The teacher version includes services such as determining the date and time of a quiz or test as well as its duration. The mobile application runs perfectly on both Android and IOS based smart phones.

2.3 Evaluation set-up

The evaluation was conducted in academic settings inside a classroom. The evaluation was conducted with a group of 104 students with almost homogeneous background about using M-learning. The evaluation process was divided into three sub phases: Preparatory Phase, Implementation Phase, and Evaluation Phase. Next is an explanation about each phase.

Preparatory Phase: Pilot study during the fall semester (2018/2019) was conducted on 50 students to test mobile application in terms of technical issues, the quality of educational material uploaded on the mobile, to test whether the used learning multimedia resources was effective (audio, pics, font size,) and to check the available types of mobile devices available between students.

Implementation Phase: Two sections of the advanced course were chosen to accomplish our study with a total number of 61 nursing students in each. The sections were randomly assigned to each group. The students were chosen because of the fact that the course learning outcomes required students to learn ECG analysis, arrhythmia interpretations and management. A total number of 104 students completed the study whereas 9 students were eliminated from the experiment group and 9 students from the control group study due to missing data in the questionnaire. The study lasted over one month during the spring semester 2018/2019.

The M-learning material including text, images, animation and video to fulfill the outcomes of ECG course concept, and each student has a secure access with user name and password to access the M-learning materials. Traditional material is available on student portal: https://portal.QQQ.edu/ to be downloaded and read. The researchers explained and demonstrated how to use the mobile application's material to the students.

Both groups were exposed to a traditional lecture on ECG which includes: normal ECG, the leads of ECG, Arrhythmias analysis and management during 4 weeks in total 12 contact hours. Furthermore, an identical pre-assessment test using paper and pencil methods was assigned for both groups to ensure that all students are equal in knowledge.

Evaluation Phase: The effect of utilizing the mobile application was evaluated through a post-test assessment for the experimental group. The order of the questions was randomly selected via the mobile applications with predefined time limit. When the 20 minutes' time elapsed, the quiz will be ended, and the students can have immediate feedback by displaying the correct answer for the wrong answered questions. For the control group, paper-pencil based quiz was used during the traditional course lecture time and the results of the test were handed back the following week.

2.4 Ethical approval

The study was approved from the faculty of nursing as well as from Helsinki Committee, Palestine (Approval no. PHRC/HC/351/18). Research objectives were explained to the students. Also, they were informed that there will be no harm consequences if they refused to participate in the study.

2.5 Questionnaire evaluation

The quantitative questionnaire was used to evaluate the mobile application from the end users' perspectives. The questionnaire was divided to the following subsections:

- Structured questionnaire consisting of demographic characteristics of the students which includes: (age, gender, GPA, year level).
- Attitudes and perception toward mobile learning which consists of 30 items (both positively and negatively worded statements were used to prevent any bias) using 5 points Likert score: Strongly agree, Agree, Undecided, Disagree, Strongly disagree. The instrument was based on Rakesh Narayan Patil et al 2016 [5].
- Barriers to mobile learning consists of the following: learning resources (limited choice; inappropriate content); smart phone characteristics (small screening size, small font size; dissatisfied interface, short stand by time); external support conditions (unstable wireless network, internet cost, and noisy learning environment). These barriers are based on [16].
- Student satisfaction with ECG course was developed by the authors of the study and based on literature. The instruments consist of 10 items with 5 –point Likert scale (1-strongly disagree-to 5-strongly agree). The reliability of the questionnaire was extracted using Cronbach alpha test, was 85.2%, which is a high degree and appropriately sufficient for the study purposes and objectives. Student satisfaction with mobile learning was adopted from a study presented in [17].
- As mentioned above students' knowledge evaluation included the following aspects: ECG analysis, arrhythmia management and interpretation. It contains 20 multiple choice questions which were obtained from the course reference book: Introduction to critical care nursing, 2017[18], and were validated by the authors and by three experts in the field of critical care nursing.

The data were analyzed using SPSS 23 version software. Concerning the interpretation of the evaluation results, we have adopted the following protocol for each positively formulated statement: Average values between 3.5 and 5 were considered as good to perfect evaluation, Average values between 2.5 and 3.5 were considered as a neutral evaluation, and Average below 2.5 indicated rather poor evaluation and suggested that improvements are needed.

Furthermore, ANOVA test was conducted for the whole questionnaire using reliability analysis. Descriptive statistics were utilized to summarize the overall trends in the data. These includes means and standard deviations. Outcome variables measured based on the 5-point Likert scale (1=strongly agree to strongly disagree=5) were analyzed using frequency, total mean calculation and univariate analysis of variance with all independent factors fitted simultaneously in the model. Level of significant was established at p value <0.05.

3   Results

3.1   Demographic data

The majority of the participants (63.5%) and (71.2%) in both control group and experimental group were between 22-24 years of age. Concerning the participants' gender, 65.4% , 57.7% of the participants were male in both control group and experi-

mental group respectively. Table 1 depicts the demographic details about the participants.

Table 1. Characteristics of the sample individuals

Variable	Category	Control group		Experimental group	
		Frequency	*Percentage*	*Frequency*	*Percentage*
Gender	Female	18	34.6%	22	42.3%
	Male	34	65.4%	30	57.7%
Age	18-21yrs	19	36.5%	15	28.8%
	22-24yrs	33	63.5%	37	71.2%

3.2 Students' attitudes

The student attitudes' results (30 items) toward the use of M-learning were analyzed. The results showed that observed score average is 3.94 indicating a positive attitude toward the use of M-learning (see Table 2). The highest score among the students' attitudes towards M-learning measuring for both groups was related to the statement "I would get benefits in my learning if M-learning is used" with score of (4.26). Whereas, the lowest score was related to the statement "M-learning hinder contribution to classroom discussions" with a score of (3.68). However, the score is 3.68 showing that the majority of students disagree with this statement.

Table 2. Students' attitude towards M-learning

The students' attitude towards M-learning	M ± SD	(%)
I would get benefits in my learning if M-learning is used	4.26 ± 0.62	85.2
I believe that M-learning provides me with rich resources	4.17±0.68	83.4
M-learning needs well prepared mobile materials	4.13±0.62	82.6
I think M-learning provides massive education for learners	4.1±0.72	82
I think M-leaning is easy to monitor the teaching and learning process	4.1±0.79	82
M-learning is effective in terms of creating a personally meaningful learning experience for me	4.05±0.67	81
M-learning needs variant teaching strategies	4.08±0.72	81.6
M-learning needs sufficient training courses for implementation	4.03±0.69	80.6
I believe that M-learning may saves my effort	4.01±0.77	80.2
I believe M-learning works well with my study plan/program	4.01±0.82	80.2
M-learning requires crucial technological infrastructure	4.0±0.68	81.6
I would feel comfortable taking courses through mobile devices	4.08±0.83	80.0
M-learning requires significant changes by the student	3.99±0.73	80.0
I think M-learning provides efficiency in learning	3.97±0.69	79.4
I think M-learning should be supplementary to traditional teaching-learning	3.91±0.87	78.2
I would like to have teaching-learning using the M-learning methodology	3.94±0.69	78.8
I think M-learning minimizes the cost of teaching and learning	3.94±0.78	78.8
I think M-learning will save my time	3.85±0.91	77
M-learning needs sufficient ground work	3.87±0.81	77.4
I think M-learning enables me to attend classes more frequently than traditional learning	3.82±0.81	76.4

I believe that I learn better through M-learning material than through lectures	3.80±0.87	76
I think M-learning enables me to understand the subject more than the traditional style of learning	3.78±0.86	75.6
I prefer M-learning to traditional learning	3.80±0.88	76
M-learning hinder contribution to classroom discussions	3.68±0.79	73.6
M-learning poses difficulty in monitoring the evaluation process	3.86±0.80	77.2
M-learning reduces teamwork and collaboration between students	3.76±0.93	75.2
M-learning causes fragmentation of work and loss of consistency in learning	3.83±0.81	76.6
M-learning causes decline in learners' academic performance	3.81±0.61	76.2
I think M-learning is uncomfortable for me	3.83±0.78	76.6
M-learning will not offer any advantages to me	3.85±0.81	77

3.3 Students' perception

The analysis of students' perceptions (8 items) towards M-learning showed that score average was 3.98. This score indicates that student perceived positively the importance of M-learning. Also, item wise percentages are given in Table 3. The highest score among the students' perception items of M-learning for both groups was related to the M-learning will bring new opportunities of learning with score of (4.3), while the lowest score (3.5) was related to the item 'Poor internet network (for mobile) in the city '.

Table 3. The mean, the standard deviation of Perception of M-learning

Perception Items	M ± SD	(%)
M-learning will bring new opportunities of learning	4.30(0.530)	86
M-learning will be more flexible method of learning as it can be done anytime, anywhere	4.14(0.683)	82.8
M-learning is a quicker method of getting feedback in learning	4.12(0.635)	82.4
M-learning can be an effective method of learning as it can give immediate support	4.1(0.684)	82.0
M-learning will improve communication between student and teacher	4.1(0.684)	82.0
M-learning cannot be used for learning due to:		
Expenses involved in Mobile learning	3.60(1.172)	72.0
Poor internet network (for mobile) in the city	3.5(1.166)	70.0
Unavailability of mobile phones with a larger number of students	4.01(0.72)	80.2

3.4 Students' satisfaction with ECG course

Answering the research questions related to students' satisfaction with ECG course, the results showed that the experimental group mean scores (4.3) were higher than the control group (4.1). Even though it was not statistically significant between both groups (P=0.91), see Table 4.

Table 4. Difference between groups Satisfaction in ECG course (N=104)

Categories	Exp.(n=52) M ± SD	Con.(n=52) M ± SD	Sig. (2-tailed)
Total	4.3(0.37)	4.1(0.56)	0.19

3.5 Students' satisfaction with M-learning

The analysis of students' satisfaction (11 items) towards the use of M-learning is reported in Table 5. It was found that 76% students were satisfied with using M-learning. This indicates that students were satisfied with M-learning integration in nursing educational domain. The statements with the highest score was "Mobile learning enables me to learn more knowledge" and the total mean scores was (3.88). Moreover, students reported that "I am satisfied with the image content in mobile learning." With a total mean score (3.88). Both statements are considered the highest level that students reported in the evaluation. On the other hand, Table 5 showed that students were less satisfied with the statement "I am satisfied with the mobile learning resources provided by my university." as the total mean score was (3.63).

Table 5. The mean, the standard deviation of Satisfaction with M-learning

	Experimental group		
#	*Satisfaction with M-learning*	*M ± SD*	*%*
1	Mobile learning enables me to learn more knowledge.	3.88 (0.758)	77.6
2	I am satisfied with the image content in mobile learning.	3.88 (0.732)	77.6
3	I can access the online courses of my university through mobile devices.	3.87 (0.784)	77.4
4	Mobile learning enables me to make better use of my learning time.	3.87 (0.784)	77.4
5	I am satisfied with the text content in mobile learning.	3.85 (0.697)	77.0
6	Mobile learning enables me to quickly solve problems encountered in learning.	3.83 (0.759)	76.6
7	I can access the digital library of my university through mobile devices.	3.81 (0.768)	76.2
8	I will use mobile learning in my future learning.	3.75(0.947)	75.0
9	Learning with mobile devices is pleasant.	3.73 (0.843)	74.6
10	I am satisfied with the video content in mobile learning.	3.69 (0.853)	73.8
11	I am satisfied with the mobile learning resources provided by my university.	3.63 (0.793)	72.6

3.6 Students' achievements

The results shown in Table 6 indicated a significance difference between pre-post quizzes achievements between the experimental and control group ($p<0.000$). As the mean scores of control group for the pre-test and post-test were 4.7 and 6.2 respectively. While, the mean scores of control group for the pre-test and post-test were 4.6 and 8.5 respectively. This study found that control group has difference of the mean scores between pre-test and post-test scores of 1.5, while the experimental group has difference of the mean scores between pre-test and post-test scores is 3.86. In other words, the obtained results indicated after using the m-learning, the improvement of learners' learning performances achieves a significant level and the mean testing score increases 3.86 points.

Table 6. The difference between quizzes achievements between control and experiment group

		Control Group			Experimental Group			
	N	*Mean*	*Std. Devia-tion*	*-t*	*Mean*	*Std. Deviation*	*-t*	*Sig. (2-tailed)*
Pre- quizzes	52	4.7115	2.20884	-1.5577	4.6538	1.64530	-3.8654	.000
post- quizzes	52	6.2692			8.5192			

Paired Differences

3.7 Barriers of using m-learning for nursing students

Table 7 revealed that a statistically significant differences were found between barriers of mobile learning and external support scores conditions was (P = 0.041). Moreover, the nursing student reported that unstable wireless network is the main barriers among external support conditions with a score of (86.5%). Furthermore, statistically significant differences were found between groups of smart phone itself barriers, and the total mean scores was 1.37 (P = 0.047). The small font size had the highest (73.1%), followed by the small screening size with score (96.2%). Moreover, no significant differences were found between different groups of Learning resources barriers (P = 0.059).

Table 7. Barriers of mobile learning for nursing students

Experimental Group				
Barriers to mobile learning	*Yes*	*No*	*M ± SD*	*P value*
Learning resources				
Limited choice	53.8%	46.2%	1.5577±.42765	.05930
Inappropriate content	34.6%	65.4%		
Smart phone itself				
small screening size	69.2%	30.8%	1.3798±.34474	.04781
small font size	73.1%	26.9%		
dissatisfied interface	51.9%	48.1%		
short stand by time	53.8%	46.2%		
External support conditions				
Unstable wireless network	86.5%	13.5%	1.4615±.2963	.04109
Internet cost	30.8%	69.2%		
Noisy learning environment.	44.2%	55.8%		

4 Discussion

The purpose of this study was to assess nursing student's attitudes, perception and satisfaction toward adopting mobile learning in nursing education. Also, this research study attempted to present some insights about the importance of integrating mobile learning in undergraduate nursing education, evidenced with better outcome achievement. In our study, we found that 100% of the students owned Smartphone's and they use it on a regular basis. This data is higher than previous studies which found that

92,6% and 96.8% respectively owned mobile devices [10,19]. The regular use and its high availability strengthen their interest in integrating it in their education [5].

Also, this study found that nursing student have a positive attitude towered adoption of mobile learning in nursing education which encourage the idea of integrating into other courses. An explanation for that is that most of our students do work at the same time with their studies which increase their interest to adopt mobile learning. These results are in line with previous studies [20, 21].

Furthermore, the results showed that nursing students' have largely positive attitudes towards mobile learning. The observed score average for their attitude is 3.94 which is higher than a previous study conducted by Al-Emran 2016 and positive perceptions regarding its implementation in their learning [11]. This is also indicated by Buabeng-Andoh (2018) [9], Students showed positive attitudes toward the use of technology, this is compatible with Briz-Ponce et al. (2017) who found that medical students have a positive attitude towards using mobile technologies for learning [10].

In our study we found that 78.5 % of the students had a positive attitude and 77% of the students perceived the importance of M-Learning in nursing education. In addition, 80% of students had positive attitude towards M-learning and 76.7% of students had perceived the importance of M-learning as asserted by Patil et al. (2016) [5]. Moreover, the study also accorded with Jan et al. (2016) who found that students showed strong support for m- learning implementation because technology have many advantages such as mobility, accessibility and flexibility [22]. This is addressed by the current study were 82.6% of the students perceived M-learning as flexible method of learning as it can be done anytime, anywhere. However, based on the study results the investigators encouraged towards the adoption of m-learning evidenced that 75% of the students are willing in the future to use it in their learning. Students expect that mobile learning will improve their learning and experiences as our students perceived that M-learning will bring new opportunities of learning process. As Jan et al. (2016) asserted in her study where students agreed that M-learning will improve their learning experiences and communication with their colleagues and teachers [22, 25].

The current study showed a statistically significant difference between the control and the experiment group in relation to posttest achievements (p=.001). In other words, the study indicated that after using the m-learning, the improvement of learners' learning performances achieves a significant level and the mean testing score increases 3.86 points. The study also found that nursing students were satisfied with M-learning integration with their study with a total mean score 3.8. When comparing both groups regarding their satisfaction with ECG course and material, the total mean was higher for the experimental group but there were no significant differences as in the study conducted by Shin-Jeong Kim et al,2017 [12]. Our explanation, achieving learning outcomes of ECG content is not easy for students, especially it needs a sufficient time to learn and grasp the complexity of arrhythmia interpretations. Therefore, using interesting teaching strategy such as simulated mobile app for complex lectures will enhance student satisfaction which is reflected in their academic achievements [23, 24].

Even though the results of this study support the integration of m-learning in nursing education, from the viewpoint of nursing students there are barriers that face M-

learning integration especially the ones related to external support conditions and the significant one is related to unstable wireless network (p=<.05), and the reason behind low bandwidth of the wireless internet at the university. Another barrier rated by students was related to smart phone itself, and the most significant barrier was small font size. This highlights the importance that the educational content is better handled by multimedia, simulation rather than just reading written materials.

The findings of this study are limited and cannot be generalized to all nursing students as this study is only collected from one course and only one topic which is related to ECG analysis and arrhythmia management. Therefore, it might be helpful in the future to expand the application in different courses. Also, the focus in this study was only assessing the attitudes of one group not taking into consideration all levels of nursing students and as a recommendation for future research to compare attitudes between nursing students and nursing educators towards adoption of mobile learning in nursing curriculum. Examining those differences will give better understanding when it comes to mobile learning adoption decision in the curriculum. For that, follow up studies are necessary to ensure the effectiveness of m-learning in nursing education. Furthermore, the investigators recommend that future study focus on the factors affecting the implementation of mobile phone in nursing education and work [26].

5   Conclusion

With today's universities puts so much emphasis on efficiency of integration m-learning in educational context and online learning activities, it is important to investigate the student's opinion about the use of M-learning. Therefore, this study attempts to assess student's attitude, perception, and satisfaction toward the integration of m-learning in nursing education. After analyzing the results, we can conclude that the students have a positive attitude toward the use of m-learning in their learning process. Also, results show that there was improvement in the student academic achievements. In light of these findings, a number of barriers to adopt the use of m-learning have been discussed.

6   Reference

[1] Forehand JW, Miller B, Carter H. Integrating mobile devices into the nursing classroom. Teaching and Learning in Nursing. 2017 Jan 1; 12(1):50-2. https://doi.org/10.1016/j.teln.2016.09.008

[2] Abu-Al-Aish A, Love S. Factors influencing students' acceptance of m-learning: An investigation in higher education. The International Review of Research in Open and Distributed Learning. 2013 Dec 10; 14(5). https://doi.org/10.19173/irrodl.v14i5.1631

[3] Farley H, Murphy A, Johnson C, Carter B, Lane M, Midgley W, Hafeez-Baig A, Dekeyser S, Koronios A. How do students use their mobile devices to support learning? A case study from an Australian regional university. Journal of Interactive Media in Education. 2015;2015(1). https://doi.org/10.5334/jime.ar

[4] Vafa S, Chico DE. A needs assessment for mobile technology use in medical education. Int J Med Educ. 2013 Nov 25; 4:230-5. https://doi.org/10.5116/ijme.5259.4a88

[5] Patil RN, Almale BD, Patil M, Gujrathi A, Dhakne-Palwe S, Patil AR, Gosavi S. Attitudes and perceptions of medical undergraduates towards mobile learning (M-learning). Journal of clinical and diagnostic research: JCDR. 2016 Oct;10(10):JC06. https://doi.org/10.7860/jcdr/2016/20214.8682

[6] Alrazeeni D. M-Learning in EMS Education--Saudi Arabia Perspective. Journal of Education and Practice. 2016;7(2):95-106.

[7] Mosa AS, Yoo I, Sheets L. A systematic review of healthcare applications for smartphones. BMC medical informatics and decision making. 2012 Dec;12(1):67. https://doi.org/10.1186/1472-6947-12-67

[8] Kim D, Rueckert D, Kim DJ, Seo D. Students' perceptions and experiences of mobile learning. Language Learning & Technology. 2013 Oct 1;17(3):52-73.

[9] Buabeng-Andoh C. New technology in health education: Nursing students' application of mobile technology in the classroom in Ghana. Interactive Technology and Smart Education. 2018 Mar 12; 15(1):46-58. https://doi.org/10.1108/itse-09-2016-0039

[10] Briz-Ponce L, Pereira A, Carvalho L, Juanes-Méndez JA, García-Peñalvo FJ. Learning with mobile technologies–Students' behavior. Computers in Human Behavior. 2017 Jul 1; 72:612-20. https://doi.org/10.1016/j.chb.2016.05.027

[11] Al-Emran M, Elsherif HM, Shaalan K. Investigating attitudes towards the use of mobile learning in higher education. Computers in Human Behavior. 2016 Mar 1; 56:93-102. https://doi.org/10.1016/j.chb.2015.11.033

[12] Kim SJ, Shin H, Lee J, Kang S, Bartlett R. A smartphone application to educate undergraduate nursing students about providing care for infant airway obstruction. Nurse education today. 2017 Jan 1; 48:145-52. https://doi.org/10.1016/j.nedt.2016.10.006

[13] Shin WS, Kang M. The use of a mobile learning management system at an online university and its effect on learning satisfaction and achievement. The International Review of Research in Open and Distributed Learning. 2015 Jun 19; 16(3). https://doi.org/10.19173/irrodl.v16i3.1984

[14] Dillon A. User acceptance of information technology. London: Taylor and Francis.

[15] Venkatesh V, Speier C, Morris MG. User acceptance enablers in individual decision making about technology: Toward an integrated model. Decision sciences. 2002 Mar; 33(2):297-316. https://doi.org/10.1111/j.1540-5915.2002.tb01646.x

[16] Xiao Q, Zhang Q, Wang L, Wang Y, Sun L, Wu Y. Mobile Learning in Nursing Undergraduates in China: Current Status, Attitudes and Barriers. Studies in health technology and informatics. 2017; 245:1314-.

[17] Mao C. Research on undergraduate students' usage satisfaction of mobile learning. Creative Education. 2014 May 5; 5(08):614. https://doi.org/10.4236/ce.2014.58072

[18] 19. Sole, Mary Lou, Deborah G. Klein, and Marthe J. Moseley. Introduction to Critical Care Nursing. St. Louis, MO: Elsevier, 2017.

[19] Boruff JT, Storie D. Mobile devices in medicine: a survey of how medical students, residents, and faculty use smartphones and other mobile devices to find information. Journal of the Medical Library Association: JMLA. 2014 Jan; 102(1):22. https://doi.org/10.3163/1536-5050.102.1.006

[20] Guo Z, Tan FB, Cheung K. Students' uses and gratifications for using computer-mediated communication media in learning contexts.

[21] Hashim KF, Tan FB, Rashid A. Adult learners' intention to adopt mobile learning: A motivational perspective. British Journal of Educational Technology. 2015 Mar; 46(2):381-90. https://doi.org/10.1111/bjet.12148

[22] Jan SR, Ullah F, Ali H, Khan F. Enhanced and effective learning through mobile learning an insight into student's perception of mobile learning at university level. International

Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN. 2016:2395-1990.

[23] Pyo MY, Kim JY, Sohn JO, Lee ES, Kim HS, Kim KO, Park HJ, Kim MJ, An GH, Yang JR, Yu HH. The effects of an advanced cardiac life support training via smartphone's simulation application on nurses' knowledge and learning satisfaction. Journal of Korean Clinical Nursing Research. 2012;18(2):228-38.

[24] Hafis M, Supianto A. Mobile Game Design for Learning Chemical Bonds with Endless Run Approach. International Journal of Interactive Mobile Technologies (iJIM). 2018; 12(8): 104-112. https://doi.org/10.3991/ijim.v12i8.9260

[25] Mercedes Rojas-Osorio, & Aldo Alvarez-Risco. Intention to Use Smartphones among Peruvian University Students. International Journal of Interactive Mobile Technologies (iJIM). 2019; 13(3): 40-52. https://doi.org/10.3991/ijim.v13i03.9356

[26] Shakir Karim, & Ergun Gide. The Use of Interactive Mobile Technology to Improve the Quality of Health Care Services in Private and Public Hospitals in Australia. International Journal of Interactive Mobile Technologies (iJIM). 2018; 12(6): 4-18. https://doi.org/10.18844/gjit.v8i3.4054

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