The Experiences of Healthcare Professional Students about the Educational Impacts of Mobile Learning

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Abstract

The role of mobile devices in learning processes is growing rapidly and it is imperative to assess the effect of this technology. This paper explores the experience of healthcare professional students with regard to the educational impacts of mobile learning. We conducted a qualitative study using a conventional qualitative content analysis based on Graneheim and Lundman (2004) method to collect and analyze the experiences of 23 healthcare professional students. Two themes, each with subthemes, emerged from the findings: (1) perceived benefit in learning process, and (2) reflective self-assessment. The results revealed that mobile learning has a positive impact on both the process and the outcome of learning in healthcare professional students. Therefore, creating a supportive condition to promote mobile learning is recommended.

Keywords

Mobile Learning, Healthcare Professional Students, Educational Impacts, Qualitative Study

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The role of mobile devices in learning processes is growing rapidly and it is imperative to assess the effect of this technology. This paper explores the experience of healthcare professional students with regard to the educational impacts of mobile learning. We conducted a qualitative study using a conventional qualitative content analysis based on Graneheim and Lundman (2004) method to collect and analyze the experiences of 23 healthcare professional students. Two themes, each with subthemes, emerged from the findings: (1) perceived benefit in learning process, and (2) reflective self-assessment. The results revealed that mobile learning has a positive impact on both the process and the outcome of learning in healthcare professional students. Therefore, creating a supportive condition to promote mobile learning is recommended. Keywords: Mobile Learning, Healthcare Professional Students, Educational Impacts, Qualitative Study

Mobile devices including laptops, personal digital assistants, and cell phones have become a learning tool given their potentials in learning (Sung, Chang, & Liu, 2016). Mobile learning (m-learning) is a new phenomenon for which the best usages are not quite clear yet (Parajuli, 2016). It can be considered as a new paradigm e-learning. Mobile learning is the use of a mobile electronic device for learning purposes (Al-Jundi, Kayssi, Papia, & Dueck, 2017; Mughal, Atkins, Morrow, & Al-Jundi, 2018; Shohel & Power, 2010). Smartphones are actually interconnected handheld computers that can be used, as advanced learning tools to provide targeted contents (Sievertsen & Carreira, 2018). The role played by m-learning in education is significant (Gezgin, Adnan, & Acar Guvendir, 2018). Over the past 15 years, mobile technology has emerged as a leading technology to improve educational outcomes (Parajuli, 2016).

The attitudes of higher education students about mobile learning have been studied by several researchers. Attitude is an effective factor in comprehending how the end-user reacts to mobile learning. International studies have reported that university students, generally have positive attitudes toward using mobile devices for educational purposes (Liaw & Huang, 2015; Ozdamli & Uzunboylu, 2015). In medical education, using mobile technology is a new experience with an increase in the attractiveness of e-learning (Lee et al., 2018).

Mobile devices are used throughout clinical settings. Physicians utilize mobile devices to improve efficiency in the workplace (Nerminathan, Harrison, Phelps, Alexander, & Scott, 2017). There is a growing demand for m-learning in medical education. One study showed that mobile learning module was effective in helping medical students learn and retain morphologic characteristics of fungi (Liu, Wang, Yen, Sun, & Yang, 2018). Another study indicated that permitting mobile devices like iPads and interactive mobile application in classroom enabled students to use them for learning purposes. Using technology intentionally and for educational purposes may increase engagement among students (Gallegos & Nakashima, 2018).

Kaur (2017) conducted a study to understand preservice teachers' perceptions of using iPads to teach math to students with learning disabilities. Result of this study showed that teachers had a positive and enlightening teaching experience using the iPad as a complement to the traditional teaching methods. Kayaoglu and Erbay Çetinkaya (2018) indicated that the integration of mobile phones into language classrooms had several advantages such as learner engagement/motivation, competence in language skills, socialization and effective leisure time as having been supported by various academic figures in the field.

Success in the implementation of mobile technology for learning purposes in undergraduate medical students is not feasible unless the end-users and the teachers recognize the impact of using this innovation. The impact of m-learning on educational performance of healthcare students has been examined by several quantitative studies. However, a limited number of qualitative studies have examined the experiences of healthcare professional students about the educational impact of mobile learning. Therefore, the present qualitative study was an attempt to explore the experience of healthcare professional students about the effects of m-learning on educational performance.

About the Authors

All authors are faculty members and have experience teaching, researching, and working clinically in hospitals. Also, all authors have experience with qualitative research methodologies, and they are all familiar with the mobile learning. The first author is an assistant professor of medical education. He specializes in medical education research, with additional interests in technology. The second author is a professor of internal medicine and has interests in education. The third author is a professor of nursing. He is an expert in qualitative research, and the fourth author is an assistant professor of nursing and has an interest in education and technology enhanced learning research. The authors, as faculty members of the university, are daily witnessing the use of mobile phones by students in academic and clinical environments. We conducted this study because of the limited available research about the experiences of healthcare professional students about the educational impacts of mobile learning.

Method

Study Design

We conducted a qualitative study using a conventional qualitative content analysis based on Graneheim and Lundman method (2004) in 2017. All research projects start with a specific question and that question dictates the path and stages of the study. Thus, the type of research method is determined by the type of question. In the case of present study, the question was "what is the impact of mobile learning on healthcare professional students?" Given the question, the adopted method should illustrate nature of the phenomena in a natural context along with the structure and factors that influence the formation of phenomena. The authors tried to find out the reality in its natural form as it is experienced by the students. That is,

instead of measuring, the authors tried to perceive the experiences. Thereby, a qualitative study was the best option to shed light on the nature of phenomena in its natural context.

Content analysis is a research method for analyzing text data that has been used extensively in health studies in recent years (Hsieh & Shannon, 2005). The qualitative content analysis method is the process of understanding, interpreting, and conceptualizing the underlying meanings of qualitative data (Thyme, Wiberg, Lundman, & Graneheim, 2013). Hsieh and Shannon (2005) identify three different approaches of qualitative content analysis based on the degree of involvement of inductive reasoning: conventional, summative, and directed. In conventional content analysis, categories emerge out of the analysis rather than through predetermined categories and or theoretical perspectives being imposed on the data. This approach is usually suitable when existing theory or research literature on a phenomenon is limited. Considering the aim of the present study and the limitation of related qualitative studies in regard to experiences of healthcare professional students about the educational impacts of mobile learning, we used conventional qualitative content analysis to explore this phenomenon.

Participants and Sampling

The research environment was Iran University of Medical Sciences in Iran. The study population was comprised of 23 healthcare professional students. We used purposive sampling methods to identify and recruit information rich cases and sampling was continued until data saturation was achieved (Polit & Beck, 2012). In addition, we asked the selected students to introduce other information-rich students who might participate in the study (snowball technique). To ensure collecting the richest and most diverse set of information, we selected the students from the widest group of participants in terms of gender, discipline, and semester (Polit & Beck, 2012). Study inclusion criteria consisted of being a healthcare professional student, having passed at least one academic term, and willingness to participate in the study. The average age of the participants was 22.79 (standard deviation=0.61); 56.52% (n=13) were female and 43.48% (n=10) male. They were all single. As to the fields of study, six participants were in medicine, six in nursing, five in midwifery, three in operation room nursing, and three in anesthesia.

Data Collection

We collected data by conducting face-to-face, semi-structured interviews with the participants (Hsieh & Shannon, 2005). The first author interviewed each participant once to share their experience about educational effects of m-learning. He interviewed the students at the university campus (classroom, office, and any place of convenience). We arranged interview appointments in advance to make sure of convenience of the participants. The interviewer began with the open-ended question: "Could you please tell me about your experiences about using m-learning." Moreover, and to have deeper insight into the concept under study, he asked follow-up questions based on the information already given by the participants. Given that the author is a research instrument in qualitative studies, he obtained guided questions from the interview texts and used in next interviews. Each student discussed several relatively recent experiences about the educational impacts of mobile learning. Average time of each interview ranged from 35 to 45min. We audio recorded all the interviews and transcribed them verbatim and performed data analysis both during and after data collection.

Data Analysis

We performed data analyses based on the method described by Graneheim and Lundman (2004). As the first step, we transcribed verbatim the interviews and reread for several times in order to obtain a sense of the whole. In the second step, we divided the important text parts into units of meaning. We then condensed and labeled the units. In this step, sub-categories were extracted. In the next step, according to the similarities and differences, we emerged the categories as the main feature of content analysis. Finally, we introduced the latent meaning of a text, which are called "themes," An example of analysis process is shown in Table 1.

Table 1. An example of analysis process

Meaning unit	The units were condensed and labeled	According to the similarities and differences, the categories were emerged	Latent meaning of the text were introduced
Now that I have replaced physical textbooks with e-books I feel more confident at the hospital. You see when you have a book in hospital, everyone knows that you are a student.	Get rid of the book under the arm problem (as a student marker) in clinical settings	Improving academic confidence	Perceived benefit in learning process
Since I started using mobile Internet, I feel more courage to participant in class discussion so that after a fast search on the web I feel more confident to participant in discussion.	More active participation in scientific discussion		
Having a smartphone makes me believe that I have access to the latest knowledge. If needed, I can update my knowledge through an easy online search.	Equipped with up to date knowledge		
I have learned a lot without asking for help and only relying on my own work and using my mobile phone.	Foster independent learning		

Trustworthiness

To address trustworthiness, we used Guba and Lincoln's criteria (Guba, 1981). To ensure credibility, we tried to manage the interviews in a cooperative environment and facilitated interactions with the participants. In addition, through field notes, memos, member checking (checking interpretations with the participants) and external checking (peer debriefing), the credibility of the data was confirmed. As well, we increased dependability by a thorough description of the study processes for the purpose of being easily audited by others. We enhanced confirmability through cross-checking by the other three members for accuracy. The research team discussed preliminary results to ensure they were a credible interpretation of the students' responses. Last, we recruited the participants with different demographic characteristics and experiences (maximum variation) in the study for enhancing transferability of the findings.

Ethics

The study was licensed by the Ethics Committee of Iran Medical Sciences University (No: IR.IUMS.REC 135.9321486002). We asked the participants to state their consent for participation orally and in written. We informed participants about voice recording, the study purposes, interview method, confidentiality of information, and their right to participate in or leave from the research. For further questions, we gave our emails and phone numbers to the participants.

Results

Data analyses indicated 562 primary codes, which was then reduced to 189 primary codes after mixing and removing overlaps. Afterward and based on similarities and differences, the codes were compared and categorized into 16 subcategories, seven categories, and two themes (Table 2).

Table 2. Main theme, categories and sub-categories of findings

Main themes	Categories	Sub-categories
Perceived benefit in learning process	A catalyst for learning	- Faster access to information - Easier and faster educational interaction
	Stepping into different learning paths	- Accidental learning - Group learning - Learning through trial and error - Just in time learning - Blended learning
	Improving academic confidence	- Get rid of the book under the arm problem (as a student marker) in clinical settings - More active participation in scientific discussion - Equipped with up to date knowledge - Foster independent learning
	Self-management in learning	- Personalized learning - Self-regulated learning - Repeatable learning opportunities - Improving time management - Collecting and managing data and information
Reflective self-assessment	Kindling the flame of learning	
	Improving theoretical knowledge	
	Acquiring clinical skills	

The following sections explain these themes, categories, and subcategories according to the participants' comments.

Perceived Benefits in Learning Process

The theme perceived benefits in learning process refers to the perception of the positive consequences that are caused by using mobile devices in learning process. The participants experienced several benefits by using mobile for learning purposes and their impression was

that m-learning had a positive effect on their learning process. Four categories were developed as part of this theme: (1) a catalyst for learning, (2) stepping into different paths of learning, (3) improving academic confidence, and (4) self-managed learning.

A catalyst for learning. This theme refers to the role of mobile devices in accelerating and facilitating learning. The students' experiences indicated that mobile technology was a key tool for accelerating and facilitating learning process. The majority of the students mentioned faster access to information, easier interaction with classmates for educational purposes, and easier access to teachers for consultation and educational purposes. In general, increase in educational interactions and relationship thanks to mobile technology accelerated and facilitated learning process. The following excerpt exemplifies how mobile devices helps the students learn faster and easier:

> It is much easier to find answers to my questions. It is no longer needed to spend time in library searching books or wait in line for an empty computer station in computer facility center to search for an answer. It is now much easier to search the Internet and find answers. (Participant No. 22)

Another common experience reported by the participants was that using mobile technology the students were able to do their homework and assignments faster and easier than before.

> With access to my email account using my phone, it is much easier to check emails and answering them. (Participant No. 12)

Both these quotes show that using mobile phones facilitates and accelerates learning and serves as a catalyst for learning and the students identified the catalytic power of mobile phones. The participants believed that by using mobile devices, they could solve workouts and problems much faster, thus improving learning process.

Another perceived benefit was that the mobile devices provided students an opportunity to experience different and diverse learning methods. This category is explained in the following section.

Stepping into diverse paths of learning. Mobile learning tools may benefit students by providing experience of different learning methods. Mobile technology enabled the participants to test different and diverse learning methods. The methods experienced by the participants were accidental learning, group learning, trial and error, just in time learning, and blended learning.

One of the most important learning methods experienced by students was the accidental learning method.

Accidental learning. The participants mentioned that learning using mobile technology was accidental in many cases. So that they would learn their course materials unintentionally in situations that they did not expect. Such learning usually happens during web surfing.

> Learning unintentionally while I am surfing the web using mobile phone is very common for me. (Participant No. 18)

Also, the students described accidental learning where they surfed the Web, networked with classmates, and checked on messages. Another method of learning that was experienced by the students was group learning.

Group learning. Mobile technology and social networks have created a chance both for learning individually (as an individual work) and learning in group through working and interacting with other students. That is, while a smartphone is a private device, it is also a tool for socialization and a great opportunity to learn while doing social activity. The following excerpt exemplifies this aspect:

> We had a virtual workshop in a group in Telegram in which the teacher was also a member. It was an interesting experience as we had a chance to take part in the discussion and give feedbacks. (Participant No. 11)

As is seen in the excerpt, mobile technology gives students the opportunity to increase the interaction with their classmates and teachers by encouraging collaboration. Also, the students mentioned that mobile virtual workshop that helped them share their experiences and knowledge with other classmates played an effective role in their learning processes. Learning with trial and error was another learning method that was experienced and reported by the students.

Learning through trial and error. Trial and error learning usually happens when the student finds a new education software and tries to explore its features. Such learning is featured with several failed attempts (e.g., to learn how to work with the software and find its new capabilities) until the student learns how to work with the software.

> I usually have no previous training about how to use the applications I have on my smartphone. I have learned to work with them only through trial and error. (Participant No. 20)

Another learning method experienced by the students with m-learning was just in time learning.

Just in time learning. This theme highlights the role of mobile devices in just in time learning. Having important information when doing a job can be a decisive factor. In other categories, it was the education situations or needs that dictated when and how the students would use their mobile phone as a learning tool. However, in this sub-category, the learner accesses the content using mobile phone when and where needed. The following excerpt exemplifies this very well.

> I was going to give a Plavix pill to a patient at heart ward, but I realized that my information about the drug was not enough. Therefore, before giving the pill, I checked generic drugs application on my mobile phone to learn about the drug and then gave the pill to the patient when I was sure. (Participant No. 7)

As the interviewee clearly expressed, the mobile devices provided the students an opportunity to experience just in time learning. Learning by the students while using their mobile phone was context dependent. Another learning method we extracted in our data analysis is blended learning.

Blended learning. Blended learning, which combines both online and traditional classroom experiences, was experienced by most students. Clearly, mobile technologies cannot answer all the learning and educational needs of the students; however, using them along with traditional learning methods and enjoying advantages of traditional and modern education approach is an effective way to improve effectiveness of learning. The majority of the

participants mentioned that they used mobile technologies along with mainstream learning methods. They believed that the combination of standard education approach and mobile technology was an effective approach to improve effectiveness of learning. The following excerpt shows this:

> I do not rely completely on mobile phone for learning as I know it is not a replacement of traditional face to face education. It is more reasonable to use the both approaches as they complete each other. (Participant No. 17)

This quote shows that the student used the blended learning to extend and supplement classroom learning.

Improving academic confidence. This theme shows the students' perception of the mobile impact in improving academic confidence. The academic confidence is the student's belief about performing a task in order to attain the academic goal. Unique capacities and functions of mobile in educational environment in particular improved the participants' belief and trust in their capabilities in the face academic challenges in different educational fields. Subcategories in this regard were no need for carry out books (a marker of students in clinical settings), more chance to participant in scientific discussions in training sessions, equipped with up to date knowledge, and foster independent learning.

Get rid of the book under the arm problem (as a student marker) in clinical settings. The students described that textbook under their arm in clinical settings identified them as students. Using electronic and software-based books instead of physical books is much easier as they are easier to carry out while they induce positive mental effects on the students. A group of students believed that thanks to e-books they no longer have to carry physical books which are a marker of students in clinical settings.

> Now that I have replaced physical textbooks with e-books I feel more confident at the hospital. You see when you have a book in hospital, everyone knows that you are a student. (Participant No. 4)

> In the past I had to bring two or three books with myself to the hospital like generic drugs or handbooks of diseases. Being seen with those books was not a good thing so that I felt unconfident when I was interviewing a patient knowing that he knows I am a student. (Participant No. 14)

As the excerpts above show, the students explained how physical books such as generic drugs or handbooks of diseases were known student identifiers. These quotes show that students are more confident in the hospital by replacing physical textbooks or notebooks with e-books in their mobile phones.

More active participation in scientific discussion. This theme refers to the mobile effect in increasing the students' participation in class discussions. Internet connectivity of smartphones and new technologies that provide faster Internet connections enable the students to search for answers to the questions asked in the classroom or other settings and feel more confident to take part in the discussions.

> Since I started using mobile Internet, I feel more courage to participant in class discussion so that after a fast search on the web I feel more confident to participant in discussion. (Participant No. 18)

This quote shows that using of mobile devices give students the opportunity to participate more in scientific and educational discussion.

Equipped with up to date knowledge. This theme refers to the role of mobile in equipping the students with up-to-date knowledge. Smartphones with internet connectivity feature facilitate access to the latest information in all scientific and specialized fields. Taking into account the explosion of science in the new age and the necessity of updating one's knowledge and information, smartphones are very useful tools for this purpose.

> Not all you find in books are updated. A few years ago, I was searching for the latest advances in CPR and I found nothing in the books; however, a short search on the Internet using Farsi and English keywords led ne to a page where the latest advances were described. I saved contents of the page and still have it on my phone. (Participant No. 3)

> Having a smartphone makes me believe that I have access to the latest knowledge. If needed, I can update my knowledge through an easy online search. (Participant No. 16)

These two quotes show that utilizing online resources with mobile technology plays an important role in equipping students with up to date knowledge and information. When mobile technology is readily available, students are able to access the up-to-date information anywhere, anytime.

Foster independent learning. This theme shows the role of mobile technology in improving independent learning. Independent learning is when a student able to learn autonomously, without the support from a teacher. Mobile technologies have made students independent players in the learning process so that they can adopt more active approaches toward the course materials.

> I have learned a lot without asking for help and only relying on my own work and using my mobile phone. (Participant No. 16)

This quote indicate that mobile learning can get students to take responsibility for their learning and as a result independent learning is strengthened in them.

Academic confidence is key for healthcare professional student success in the classroom or clinical settings. Overall, the findings indicate that using mobile technology for learning purpose can boost students' academic confidence in different ways. Another category we have extracted in our data analysis is related to self-management in learning.

Self-management in learning. This theme highlights the role of mobile devices in regulating of the student behaviors to achieve learning goals. Thanks to mobile technology, the majority of the participants expressed control over their learning process. They had constructive and effective reactions in different situations using their mobile phones. This category consisted of four sub-categories of personalized learning, just in time learning, more appreciation of time, and gathering and managing data and information.

Personalized learning. This theme refers to the role of mobile in customizing learning path based on the student's progress, needs, skills and motivations. Different students have different educational needs. Studying and learning what is needed or interesting for the students was mentioned by the participants. This indicates that using mobile phones, the students had a personalized learning experience. The following excerpt exemplifies how mobile devices helps the students facilitate personalized learning environments:

> I have an English learning application on my phone which evaluates my English skills and I can skip the courses that are unnecessary or have nothing new for me. (Participant No. 7)

> Using my mobile phone I can learn only the material that I needed or interested in. (Participant No. 14)

As is seen in the excerpts, the mobile devices could be a powerful tool for personalized learning.

Self-regulated learning. This theme describes the role of mobile technology in the process of controlling and evaluating students learning. A group of the participants mentioned that they used mobile phone to design, control, and manage their learning process and even evaluate it.

> Interviewee 19 can express this point as follows:

> Using my smartphone I can now design plans for educational work and determine deadlines. This feature is like having a personal manager who reports about how things are going on. (Participant No. 19)

As the excerpt above shows, the mobile devices can help students control their learning process. Programming for education at the moment on for weeks, months, or even for years ahead using mobile technology was an opportunity for the students to define a road map for their learning process and receiving specific training programs.

Repeatable learning opportunities. One of the factors that facilitated learning process was the possibility to repeat the learning opportunities. The following excerpt shows this view:

> I have an application installed on phone, which enables me to listen to the whole materials for several time, which is a very good thing. (Participant No. 14)

As the interviewee expressed, mobile phone provided repeatable learning environment for the students that facilitates the learning process.

Improving time management. The majority of the participants said that mobile phone was a great device to save time so that they could use their time in a more optimum manner. Mobile phone can perform a wide range of functions which save time of students. One of the students stated,

> Sometimes and by reading e-books or other content, I make a good use of the idle times like when I am caught in a traffic jam or in a bus or subway. In this way I use my time in a better way. (Participant No. 14)

As the excerpt above shows mobile phone, if used correctly, is a great tool for helping students to save time that facilitates the learning process. The possibility to learn anywhere, anytime that is provided by smartphone enables students to use their time optimally.

Collecting and managing data and information. Most students said they used mobile audio and video capability for educational purposes. Mobile SD card memory is a reliable tool to save and manage data of different types like text, audio, and video files. The content can be used, processed, and modified for several times. One of the students mentioned,

> Mostly I ask for teachers' permission to record an audio file of the class and then use the file to complete my notes. (Participant No. 17)

As the interviewee expressed, capability of making audio recordings of mobile can be used to make educational resources. This capability is an opportunity for students to collect and manage educational data and information for learning purposes.

In general, the results showed that mobile devices facilitated learning process and consequently improved the learning outcomes of students. This issue is explained in reflective self-assessment theme.

Reflective Self-Assessment

This theme refers to the participant's self-assessment of learning and learning performance after using m-learning. One of the items that had been frequently experienced by the participants was the effectiveness of mobile phone in different fields of learning. The students believed that mobile phone improved their learning performance in different ways. The categories were learning motivation, development of theoretical knowledge, and acquisition of clinical learning.

Kindling the flame of learning. The result of this study indicated that the using of mobile devices during the training sessions positively impacted students' interest and motivation to learn. The participants mentioned that their interest in learning mobile technology and electronics and curiosity about electronics improved their motivations and interest in learning and studying. In most of the cases the desire was motivated by inner motivations and in absence of external pressures.

> In general, I feel more interested in study. Without an external pressure, I use mobile phone to read scientific materials in scientific channels and groups. (Participant No. 14)

> I study more scientific materials, since I bought my smartphone and learn its potential to access scientific contents, I tend to study more. Before this, I used to study only the textbooks and notes for final exams. However, know I read scientific materials in online group and or forward them to my friends. (Participant No. 18)

As the quotes above clearly show, the students said they feel more motivated to learn when using mobile application. The students did not have to rely heavily on the instructor to motivate them to use mobile for learning purpose because the mobile application were motivators themselves.

In addition to the effects of mobile learning on affective domain of learning, mobile learning also had an impact on the cognitive domain of learning (theoretical knowledge), which is explained in the next theme.

Improving theoretical knowledge. This them focuses on acquisition, retention and usage of knowledge. The majority of the students mentioned that using mobile technology for learning purposes improved and developed their theoretical knowledge and information. The majority of the study used mobile for better comprehension of complicated scientific topics or build new theoretical knowledge.

> I have my smartphone to thank for a lot of information that I know about drugs. Using it has given me the chance to learn a lot about new drugs. (Participant No. 9)

> I know a lot about patients' diets and this has become possible using my mobile phone. (Participant No.10)

As the excerpts above demonstrate, the participants used their mobile phones to gather information. This information gathering improved theoretical knowledge about a clinical topic.

Acquiring clinical skills. Acquiring clinical skills is one of the most important part of education and learning for healthcare professional students. In this regard, some of the students mentioned that m-learning was highly effective in learning or improving clinical skills. Watching video clips on clinical techniques or practicing clinical skills using e-games on smartphone were effective in improving their clinical knowledge.

> I have a software that illustrates the whole process of physical examination so that I can review and improve most of my clinical skills of physical examination. (Participant No. 10)

> I learned suctioning and NG tubing by watching educational animation. I had learned theoretical and practically before in classroom; however, that animation was a great improvement of what I had learned before. (Participant No. 1)

As the quotes above show, the using of different apps played an important role in clinical skills learning of students. Clinical skills are the core of healthcare professional and every healthcare professional student must be competent in performing them. The results suggest that application of mobile phones to education has a positive effect on the development clinical competence among healthcare professional students.

Discussion

This study was conducted to understand the impacts of mobile technology in healthcare professional students. Overall, the students had a positive experience using mobile phones as a supplement in addition to the traditional learning methods. Taking into account the fast-growing technology that increasingly make everyday tasks more efficient, effective, and convenient, the desire and demand for using the technology in education are growing. The findings were strong evidences that mobile devices are commonly used by students for learning in classroom and clinical settings.

The results indicated that not only m-learning affects orientation of learning activities in learning process, it also has positive effects on learning outcomes in medical students. In other words, mobile technology positively affects both the learning process and the learning outcomes. The majority of recent studies on m-learning in medical students have emphasized on learning outcome rather than the process of learning. As a result, we know a little about the effects of m-learning on learning processes in medical students.

The impact of m-learning on educational performance of healthcare students has been examined by several quantitative studies. For example, Liu et al. (2018) reported that the smartphone-based wallpaper learning module was effective in learning and memorizing morphological characteristics of fungi in medical students and residents. Another study conducted to evaluate the effectiveness of using mobile applications for teaching cardiopulmonary assessment in comparison with using a high-fidelity human patient simulator. Results indicated that the mobile applications could be used as an educational tool for memorizing and learning purposes with the same effectiveness as the high-fidelity human patient simulator (Yoo & Lee, 2015).

Compared with the previous studies mentioned above, since the present study has been conducted with a qualitative approach, provides deeper insight into the advantages of m-learning so that some of the findings were new and were not reported by earlier researchers and some were consistent with the previous studies.

Improving academic confidence was one of the extracted categories so that using mobile technologies in education environment improved students' education confidence in different ways. For instance, the participants mentioned that using e-books instead of physical handbooks and generic drugs books at clinical settings had a positive, psychological effects on them. They believed that books were a marker of students from the patient or their families' points view. This aspect is not mentioned in the previous studies.

Data analysis revealed that the participants used their mobile devices for easier and faster access to information. The easier information gathering facilitated learning clinical topics at the bedside and the understanding would be augmented afterward.

The majority of the students stated that m-learning was a learning catalyst given the capability to access information faster through mobile technology. Previous studies have also mentioned fast access to information and facilitation of learning as of advantages of m-learning (Dimond, Bullock, Lovatt, & Stacey, 2016; Strandell-Laine, Stolt, Leino-Kilpi, & Saarikoski, 2015).

Moreover, m-learning enabled the students to experience different learning methods. Consistent with other studies, one of the key learning methods, mentioned by the participants in this regard, was incidental learning (Chan, Walker, & Gleaves, 2015). Incidental or serendipitous learning usually takes place as an unplanned event embedded in everyday mobile practices and it is of short durations. This consists of learning incidentally while the students play mobile game or spend time in social networks.

Another advantage of m-learning notified in previous studies on non-medical students was just-in-time learning. This kind of learning refers to access to the knowledge only when it is needed. Using m-learning gives medical students the chance to have access to information in clinical settings. Using mobile technology one can access information anytime, anywhere under any circumstance especially in clinical settings. Developing knowledge is a critical part of learning and the students used their mobile devices for rapid access to information during clinical training (just in time learning). This ensures sufficient knowledge for interactions between the students and the teacher or the patient.

Reflective self-assessment showed that m-learning improved student's interest in learning and their learning performance in cognitive and skill fields. As the findings indicated, medical teachers may utilize m-learning strategy to facilitate realizing educational objectives

in all the three domains of learning. This is consistent with previous systematic reviews that reported using m-learning strategy in medical education may have positive effects on learning in all the three domains of learning—that is, cognitive, affective, and psychomotor (Koohestani, Soltani Arabshahi, Fata, & Ahmadi, 2018).

Mobile technology for healthcare professional students is a part of daily life and it is essential that teachers revise or adapt their teaching in order to enable students using their mobile devices in a proper and efficient way (Koohestani, Arabshahi, & Ahmadi, 2018). To practically implement m-learning in university setting, the students and officials need to recognize the necessity of using mobile for educational purposes. In addition, students and officials need to be open-minded about the potential advantages of m-learning. Providing a supportive and positive environment for m-learning was one of the critical factors in promoting m-learning in students. Teachers play a key role in creating a positive psychological atmosphere in the classroom (Koohestani & Baghcheghi, 2016; Sohrabi, Koohestani, Baghcheghi, Delavari, & Rezaei Shahsavarloo, 2017).

The finding highlighted the importance of m-learning and its rapid expansion in the world, necessity of life-long learning, and expansion of technology in all aspects of life including learning-teaching process. In light of this, education authorities need to update the learning-teaching process and develop a supportive culture and environment in schools. Policy makers and decision makers of medical education need to prepare the ground for a shift from traditional educational method to modern and advanced approaches that are adopted at international level. It is notable however, e-learning methods including m-learning can never completely replace face to face classroom education. It is important to remember what the actual essence of m-learning is, what the advantages are, and when and how it can be used.

Using m-learning devices can be a source of positive effects on the learning experience of healthcare professional students. They can find many benefits in the learning process and outcomes. The findings indicated that it was possible to provide m-learning devices to support learning in both educational and clinical environments. Thereby, a supportive environment for m-learning is required. Information reported in this paper could be used by medical students, educators, and designers of m-learning systems.

To make sure that the students were familiar with mobile technology, the study population was limited to the undergraduate students. These students are mostly at the same age group and they can be considered as "digital native" generation. On the other hand, adding graduate students could have created unique perspectives.

As a qualitative research, the findings are not generalizable to a larger population but may be transferable to similar environment. The results of this research can be used as baseline data for researchers, teachers and policymakers in the field of education. Future studies with different students, schools and countries are necessary to address these issues further.

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