dHealth 2022
G. Schreier et al. (Eds.)

doi:10.3233/SHTI220375

Challenges and Facilitators of Using Smartphones in Educational Activities: Medical and Nursing Students' Perspective

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Abstract. Background: Todays, smartphone technologies and applications are used in the medical and nursing fields. Medical and nursing students are among the groups in which the use of these tools is observed. Objectives: To investigate their views on the barriers and facilitators of the use of these technologies. Methods: Four hundred people (200 people from each group) were invited randomly. A questionnaire was used to collect data. To collect data, hospitals were referred and the questionnaires were provided to students and after completion, they were collected. Data analysis was performed using SPSS software and descriptive and inferential statistics. Results: The most important barriers from the students' view included internet problems in the university or hospital, lack of technical support for this technology in the hospital or university, the quality of existing applications, lack of appropriate Apps in the local language, non-introduction of appropriate Apps and not knowing the right Apps. The most important facilitators were the appropriate support services in the university or hospital, placing the appropriate Apps on the department or university website, designing native Apps with the participation of experts, and introducing the appropriate Apps by professors or universities. Conclusion: The use of Apps is increasing among medical and nursing students. In this regard, attention to the existing barriers and their elimination and strengthening the facilitators, and providing the necessary technical and educational infrastructure to facilitate the useful applications should be considered by decision-makers.

Keywords: Mobile Technology, Mobile Applications, Medical Education, Nursing Education

1. Introduction

Although digital health offers chances to improve healthcare quality, efficiency, and safety, the adoption of digital tools and technology has been slow [1]. Mobile learning (mLearning) technologies (such as tablets and smartphones) are becoming more prevalent in the clinical setting and have a positive impact on clinical learning and

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communication [2]. These tools have different capabilities and Apps that include diagnostic guides, medical calculators, general and specialized pharmaceutical information and references [3-5], video tutorials, reference, and standard laboratory values, connectivity to electronic journals [3], simulated care environment [6], laboratory testing guide, drug interaction guide, nursing care guide, clinical examination guide [7], physical examination tools, anatomy atlases [8], storage and management of patient data, assistance in controlling and monitoring medical students [9, 10], and decision support for diagnosis and treatment [11].

According to a study, the daily use of smartphones in medical fields has become critical for personal and professional uses [12]. A study indicates that factors such as poor device functionality, the social aspects of technology, learning how to use a device, and institutional infrastructure and policies need to be addressed [13]. According to studies, the portability of mobile devices, their institutional integration, additional support for learners and educators to fully comprehend device or App functions, and device training and maintenance services are all important factors in continuing to use smartphones and mLearning tools [2, 13].

Another study conducted among medical and nursing students in Iran discovered that nursing and medical students made extensive use of smartphone Apps. Students viewed the benefits of these technologies for their education in terms of utilization rate and benefits such as students' efficiency, improved quality of care, faster accessibility of information, and the positive effect on education[14]. According to another survey conducted in Iran, the most commonly used applications among medical and nursing students are medical dictionaries, drug software, medical calculators, anatomical atlases, and nursing care guides [15]. However, there are several limitations to utilizing these technologies [14]. Knowing these barriers and facilitators of technology use among students will aid in promoting its use. The goal of this study was to find out what students thought about the facilitators and barriers to using this technology.

2. Method

Participants included medical and nursing students working in teaching hospitals of Tehran and Iran Universities of Medical Sciences. The sample size of the two groups (medical and nursing students) was equal to 400 people (200 people from each group). Then, by referring to each hospital and inquiring about the number of students in that hospital, the required number of samples in each hospital was calculated proportionally. We applied a simple random sampling method in each hospital.

The data collection tool was a questionnaire. We asked questions related to barriers and facilitators of the use of mobile technologies in a 5-point Likert from very low to very high.

To ensure validity and clarity, the questions were designed based on a review of the literature. Then, three faculty members of health information technology departments, three nursing students, and three medical students reviewed the questions to express their views on clarity and necessity of questions. The answers to the questions ranged from very clear to completely vague (for the clarity) and absolutely necessary to completely unnecessary (for the necessity). The answers were scored from 4 to 1, respectively, and the mean scores were calculated separately for clarity and necessity. Questions with a mean "necessity" score of less than 2 were removed. Also, questions with a "clarity"

score of less than 2 were corrected based on the suggestions. The same group re-reviewed and confirmed the revised questionnaire.

For reliability, the test-retest method was used. The questionnaire was completed by five medical students and five students within 10 days. The results showed no significant differences between the two rounds in any of the questions. Also, the questionnaire was completed by other 30 students (15 people from each group) and Cronbach's alpha for barrier and facilitator questions was calculated (0.83 and 0.85), respectively.

After collecting questionnaires, data were analyzed based on descriptive methods. The answers were scored (1-5 for very low to very high) and the mean scores were calculated. T-test was used to compare the views of medical and nursing students.

3. Results

Finally, 372 students (186 medical (52.2%) and 170 nursing students (47.8%)) participated. 16 people did not declare their field of study. Among medical students, 84 and 102 were interns and residents, respectively. The most used technologies among medical and nursing students were smartphones (60.8% and 62.4%, respectively). 29.6% and 12.9% of medical and nursing students used both tablets and smartphones. Others mostly used tablets.

According to Table 1, the most important barriers based on medical students were: Internet problems in the university or hospital (4.11), lack of technical support (3.91), lack of confidence in the quality of existing Apps (3.76), lack of appropriate Apps in the local language (3.74), non-introduction of appropriate Apps by professors or university (3.74) and lack of knowledge of appropriate Apps (3.72). The most important barriers among nursing students were: Internet problems in the university or hospital (4.04), failure to introduce appropriate Apps by professors/universities (3.91), lack of technical support for this technology (3.88), lack of appropriate Apps in the local language (3.85), purchase cost (3.83), the quality of existing Apps (3.82), and lack of knowledge of appropriate Apps (3.82). Medical and nursing students had the same opinions about the barriers to using smartphones in education. However, the cost of purchasing ($p = 0.024$) was more important for nursing students.

According to Table 2, medical and nursing students mentioned all of the questions as important facilitators (scored more than 75% of the possible score). However, appropriate support services in the university or hospital environment (4.19), placing appropriate Apps on the department or university website (4.10), designing native Apps with the participation of experts (4.05), and introduction of appropriate Apps by professors/universities (3.99) were the most important ones for medical students. Placing the appropriate Apps on the department or university website (4.22), introducing the appropriate Apps by professors/universities (4.17), providing appropriate native Apps (4.15), and appropriate support services in the university or hospital (4.14) was the most important facilitators for nursing students. Medical and nursing students have a similar opinion about the facilitators; however, nursing students considered the design of appropriate Apps in the local/native language (p-value =0.019) and the obligatory use of Apps more important than medical students (p-value = 0.049).

Table 1. Comparison of medical and nursing students' views on barriers of educational use of smartphones

Statements	Medical students (mean ± SD)	Nursing students (mean ± SD)	P-value
Little knowledge of students about how to use	3.64 ± 0.81	3.63 ± 0.88	0.905
Students' lack of interest in these technologies	3.4 ± 0.95	3.25 ± 1.04	0.168
Lack of user-friendly technologies	3.43 ± 0.97	3.32 ± 1.08	0.327
The high cost of purchasing these technologies	3.62 ± 0.98	3.83 ± 1.06	0.024
Learning to use these technologies	3.29 ± 0.99	3.31 ± 1.11	0.520
Lack of introduction of appropriate App by professors and universities	3.74 ± 0.86	3.91 ± 0.86	0.055
Fear of professors' reaction	3.44 ± 0.98	3.4 ± 1.12	0.850
Lack of technical support for this technology in the hospital or university	3.91 ± 0.89	3.88 ± 0.86	0.593
Lack of knowledge of students about appropriate App	3.72 ± 0.76	3.82 ± 0.91	0.130
The possibility of breaking or losing these technologies	3.48 ± 0.96	3.36 ± 1.12	0.361
Low device memory	3.5 ± 0.98	3.39 ± 1.14	0.440
The small screen size of the device	3.51 ± 1.02	3.44 ± 1.12	0.561
Hardware problems of the device (hang up, ...)	3.6 ± 0.98	3.47 ± 1.11	0.309
Internet problems in hospital or university	4.11 ± 0.81	4.04 ± 0.88	0.579
Lack of appropriate software in local language	3.74 ± 0.97	3.85 ± 0.88	0.589
Uncertainty about the quality of existing Apps	3.76 ± 0.98	3.82 ± 0.91	0.650

Table 2. Comparison of medical and nursing students' views on facilitators of educational use of mobile technologies

Statements	Medical students	Nursing students	P-value
Introduction of this technology and suitable Apps by professors	3.99 ± 0.97	4.17 ± 0.86	0.097
Introducing students to the benefits and how to use this technology	3.96 ± 0.85	4.10 ± 0.85	0.083
Existence of appropriate support services in hospitals and universities	4.19 ± 0.79	4.14 ± 0.81	0.639
App development with the participation of qualified experts	4.05 ± 0.79	4.00 ± 0.86	0.644
Providing appropriate educational and clinical Apps in local language	3.92 ± 0.95	4.15 ± 0.89	0.019
Putting the right Apps on the department/university website for downloading	4.10 ± 0.79	4.22 ± 0.85	0.080
Mandatory use in hospitals or classrooms	3.75 ± 1.02	3.99 ± 0.91	0.049

4. Discussion

We found that medical students considered university or hospital Internet problems, lack of technical support, lack of confidence in the quality of existing Apps, lack of appropriate Apps in the local language, failure to introduce appropriate Apps by professors or university, and unknown appropriate Apps as the most important barriers. Nursing students also considered Internet problems, non-introduction of appropriate Apps by professors, lack of technical support for this technology in the hospital or university, lack of appropriate App in the local language, cost of purchase, quality of Apps, and unknown appropriate Apps as the barriers. There was no difference between the opinions for most of these barriers.

In a study, Canadian medical and nursing students identified small size Personal Digital Assistants (PDAs) as the main drawback and believed that because of the small size of the device, a lot of time was spent [16]. This is not in line with our study. Although students pointed to this barrier, it was not one of the high-priority ones. Advances in technology in recent years have led to the introduction of newer technologies with larger and better screens and better facilities. In a US study, designed drug information references for PDAs were evaluated by nurses and found that the best system answered only 72% of the questions, and some databases had incorrect answers. The study showed that one of the important barriers to the use of these databases is the lack of guidance in selecting the appropriate drug information Apps [5]. In our study, medical and nursing students stated that not knowing the appropriate Apps, not introducing the appropriate Apps by professors, and non-confidence in the quality of existing Apps are important barriers to the use of these technologies in education. Another study for assessing the impact of mobile learning (mLearning) devices in the clinical learning environment on medical students' studying habits suggests mLearning devices have a positive effect on the students' perceived efficiency of working; however, the Internet is a fundamental limitation to optimal device utilization [2]. These results are consistent with ours on the positive impact of mLearning devices and existing barriers such as Internet problems and technology infrastructure and the lack of appropriate software.

Another study in the United States showed that technical problems, lack of training and technical support (23%), and lack of knowledge and discomfort with mobile technology (15%) were among the most important obstacles [4]. In a study at the University of Nairobi, students' use of mobile Apps was assessed. The most important barriers based on medical and nursing students included technical problems, access to the appropriate program, internet problems, and purchase costs [17]. Regarding technical problems, the results of this study are consistent with the present study.

Undergraduate nursing students in Sweden expressed concern about the feelings of others (for example, imagining playing or listening to music), fear of the reaction of opposing nurses, and poor appearance in front of patients as the disadvantages of using technology [18]. A UK study on medical students showed the negative feedback from patients or colleagues, the possibility of theft, the possibility of device damage as the obstacles [19]. Another UK study showed that software technical problems and lack of patient acceptance are important barriers that need to be overcome to increase usage [20].

Similar concerns were also expressed by the students in our study, but they did not prioritize these. A recent scoping review indicated improved communication among health team members and challenges related to distraction, information privacy, organizational policies, and patient perception should be considered for M-health in

nursing [21]. The findings of this study are consistent with our findings in terms of organizational policies for using Apps, and technical support for this technology. An integrated review on barriers for mobile device discussed for 11 included studies and showed that Internet connectivity problems were the main challenges reported for using of mobile devices [22].The result is consistent with our study in terms of challenges in infrastructure and network.

In most barriers, there was no significant difference between medical and nursing students; however, there was a significant difference regarding "the high cost of purchasing technologies", which showed that this barrier is more important for nursing students. Therefore, this barrier should be more concerned for nursing students.

According to findings, medical students considered appropriate support services, placing appropriate Apps on the department or university website, designing native Apps, and introducing appropriate Apps by professors as the most important factors. Likewise, nursing students considered placing appropriate Apps on the department or university website, the introduction of appropriate Apps, the provision of appropriate native Apps, and appropriate support services as the most important facilitators.

A study on the use of PDAs by nursing students found that students considered the most important facilitators, including ease of use of technology and classroom requirements [4]. A study in Korea on points of view of students, faculty, and staff found that ease of use of mobile technology led to satisfaction [23]. A study was conducted in the UK on medical students showed that change in behavior, attitude, and approach of professors to use these technologies in clinical ward rounds and the clinic and teaching students to use these technologies is low [19]. An Iranian study showed that only 16.8% of medical students stated that the Apps were introduced by professors. Factors such as introducing Apps approved by scientific and reputable institutes, financial aid for purchasing, ease of use, and increasing the technical skills of using these Apps were introduced as effective factors in increasing the usage [24]. In another study, the students' knowledge about the use of Apps for education, diagnosis, and treatment was not desirable [25], which reduced the use, and action should be taken to eliminate these barriers. Another study in 2019 demonstrated the feasibility and acceptability of using electronic tablets among healthcare providers should be considered [26]. The results of this study are consistent with our study, regarding removing existing barriers and providing technical infrastructure (local internet access) to facilitate the useful use of these technologies. A qualitative systematic review regarding facilitators of mLearning strategies for medical and nursing highlighted the importance of efficiency and personalization, device functionality, social aspects of technology, especially in a clinical setting, learning how to use a device, the importance of institutional infrastructure and policies [13]. Poor device functionality, emphasis on the social aspects of technology, interaction learning for clinical practice, and infrastructure and policies were all suggested to resolve in this study, and these results were consistent with the results of our study.

Another study showed that while nursing students preferred their portable laptops, those in higher classes were more inclined to favor mobile phones but there was no significant difference between them in terms of ease of use, perceived usefulness, personal innovativeness and self-management of learning of these technologies [27]. According to another study although there was a clear difference between medical students and doctors about the App features and types but both groups had similar view on usefulness of Apps [28]. These results are consistent with our study.

We found no significant differences between medical and nursing students on the most of facilitators of using Apps; however, "providing appropriate educational and clinical Apps in local language" and "mandatory use of Apps in hospitals or classrooms" are more important for nursing students.

There are few studies regarding comparing the medical and nursing students regarding use of Apps in their education. Another study in line with our study, found no obvious differences between the usage of these technologies by medical and nurse practitioner students for the improvement of clinical learning and promotion of reflective learning in practice [16].

5. Conclusion

Students have positive perceptions toward using mobile technologies in educational settings. There are many obstacles to the adoption of these technologies, the most important of which are related to technical and infrastructure issues (such as lack of technical support for this technology and Internet problems in the hospital or university). Students' lack of understanding of useful Apps or absence of appropriate Apps, as well as their ambiguity about the quality of existing Apps, should be considered. There is no significant difference between medical and nursing students on barriers and facilitators except for high cost, providing educational Apps in local language and mandatory use in hospitals. As a result, experts are recommended to develop appropriate Apps for students and introduce high-quality Apps for medical and nursing students.

Acknowledgment

This study received ethical approval from the Research Ethics Committee of Iran University of Medical Science (IR.IUMS.REC 1395.95-04-67-28700). The authors declare that there are no competing interests either financially or non-financially in this study.

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