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Comparison of the effect of two teaching methods on surgical technologist students' learning and satisfaction (flashcards vs. mobile-based learning)

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Abstract:

BACKGROUND: M-learning is "learning across multiple contexts, through social and content interactions, using simple hand-held technologies, wireless and mobile network. This personal electronic device is a way to facilitate the transfer of learning and improve teaching. Hence, the researchers decided to design a mobile-based learning application to teach surgical instruments comprehensively and compare students' learning and satisfaction in both mobile-based learning and flashcards methods.

MATERIALS AND METHODS: An interventional study was conducted on surgical technologist students in Alborz University of medical science (2019). Students were divided into two groups: flashcards ($n = 21$) and mobile application learning group ($n = 21$). The difference of pre- and post-test scores was considered for the evaluation of learning level in two groups. Data were entered into SPSS 20.0 software and analyzed by statistics tests. Data were analyzed by a paired *t*-test, independent *t*-test, and Pearson's correlation coefficient.

RESULTS: There was no significant difference in students' knowledge level between two groups before intervention ($P = 0.87$) but there was significant difference between groups after the intervention ($P = 0.003$). In the evaluation of student's satisfaction, the mobile application was preferred by 84.28% of students.

CONCLUSION: Given the effectiveness of using both methods (flashcards and mobile application), it is recommended that these methods especially mobile application be used for surgical instruments education.

Keywords:

Apps, flashcard, mobile-based learning, surgical instruments, surgical technologist

Introduction

The continuous change is a one of the social challenges in the 21st century. Traditional methods of teaching and learning to have lost their effectiveness with new technologies and methods, nowadays.^[1] Learning anytime and anywhere has become

now a reality with the advancement of wireless technologies and mobile learning.^[2] The flashcard is one of the easiest ways to learn that frequently used. It is an effective way of memorizing content because of the ability to read content at any time and place.^[3] Eslahcar Komachali and Khodareza, found a significant difference between the two groups of flashcard users, and

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the control group in vocabulary learning. They have known the sensible role of flash cards in training.^[4] The favorite device and mobile technologies are a mobile phone. The main advantage of mobile learning is simply its accessibility. The other mobile learning benefits are learning flexibility, more availability, low cost, convenience for the learner, continuous communication, interaction between learner and tutor, and between learner, and other learners, self-assessment skills.^[5] This communication and information device due to its specific characteristics can play a complementary role in education.^[6] Most importantly, its popularity is multiple capabilities of this device.^[7] Which can shape learning more effectively.^[8] Komer *et al.* expressed the mobile is fast tools and new opportunities, with the flexibility of time and space. They believed that the learning method using mobile has Time-Space Flexibility and is more pervasive.^[2] Since 2007, the mobile-based education system was formally introduced in the UK, Sweden, and Italy. They have been covered the student who left school at the age 16–24 years old.^[6] Using a smartphone is growing in the health-care professional (HCP) during the last decade. It is used as an effective supplement to traditional education.^[9] According to Nason *et al.*'s study, many urology residents use smartphone apps on their phone, and they believed it was effective in empowering them.^[10] Today, in the field of surgery, the use of applications in health service provision and education plays a valuable role.^[11] Clarke *et al.*, in their study about simulation-based training for burr hole surgery instrument recognition shows that this teaching method has had a positive effect on residents' learning, and it reduces the risk of error in identifying tools and saves time for learning.^[12] Given that, current students are more different from past students. Expanding progress has provided many capabilities for using technology and performing multiple tasks at once. Therefore, these students are considered as third-millennium students. The use of modern technologies changes the modality of education, and it can help students and teachers regarding time, place, and different educational needs until improving their knowledge and skills at any time and place. Hence, it seems, the need to learn mobile learning is necessary for continuing education in the medical community and the use of this technology is expanding in clinical education.^[10,13,14]

Papzan AAH and Soleymani Adel, state in their study that the lecture training and m-learning methods have a positive effect on student's learning, but m-learning is more effective than lecture training for student's learning.^[15] Christopher Cheong considered that students learn, study skills, and the ability to work with mobile very early. Therefore, the students needed to be supported in the positive and effective uses of mobile systems.^[1] Therefore, it should make greater use of this

tool to enhance Students' knowledge by recognizing its capabilities. The use of mobile software applications by HCPs has revolutionized to transfer medical knowledge. We see a new application in a one of the themes and medical procedures in the form of games, movies, and animations every day which greatly facilitates data transfer capability. The most important topics in the training of surgical technologists are their familiarity with surgical instruments. Since these tools are in a wide variety and number. Therefore, they should be trained with different visual training techniques for effective remembrance. Using the flashcards is a visual training technique that used as an adjunct to learning surgical instruments that make learning possible by seeing the shape of the tool and providing a brief explanation of its utility. Based on the researchers' experience as a lecturer with experience in teaching this lesson shows students' reluctance to use this method for a variety of reasons, including missing flashcards, leaving home while they were always playing mobile games.

Hence, the researchers decided to design a mobile-based learning application to teach surgical instruments comprehensively and compare students' learning and satisfaction in both mobile-based learning and flashcards methods.

Subjects and Methods

Study participants and sampling

An interventional study was conducted on surgical technologist students in Alborz University of Medical Science (2019). All eligible 42 students by simple census sampling have entered into this study. Students were divided into two groups: flashcards ($n = 21$) and mobile application learning group ($n = 21$).

Study design and setting

Before conducting the study, pretest was done with 50 online questions to determine the Student's baseline knowledge. The content of flashcards and mobile applications included general surgery, gynecology, orthopedics, and neurosurgery instruments. The mobile application has a license number in 20105506 in digital technologies center and mart media. This application is designed in java context and eclipse IDE for Android-powered smartphones and recommended Android 2.2 and above. This format is based on Extended Markup Language and visual effects software editing in Photoshop CC. The program has >50 actuates and classes and >100,000 lines of code). On the other hand, a Content Management System has been developed with the LAMP system (Linux-Apache-MySQL-Php) and that's on Dominion alborzexam.vvs.ir. Students are introduced to each set of surgical instruments every day. At the end of the day, they could assess their learning

status by conducting a self-test designed in the program. The duration of the implementation phase was 21 days. The same time was allocated for training the students in flashcards group. After completing the course, the groups were evaluated by the online test program again. Students' Average Test Scores were assessed in pre- and post-intervention. After the examination, participants in flashcards group were given the mobile phone having installed mobile applications and flashcards were given to mobile-based learning.

At the end of the semester, Students' satisfaction was assessed by a researcher-made Likert scale questionnaire in both the groups. The questionnaire consisted of 10 questions, including the availability of flashcard or application, feasibility to use two methods, a favorite method, repeatability, effective feedback, motivated to study, worrying about missing or ruined, cost, usable at any time, and any place, innovative and a general question about students' views on comparing methods. A code was defined for all students, and all students' information has been reviewed anonymous.

Data collection tool and technique

Data were analyzed using SPSS 20.0 software (IBM company, USA). The normality of data was evaluated by the Kolmogorov-Smirnov test. Data were analyzed by a paired *t*-test, independent *t*-test, and Pearson's correlation coefficient.

Ethical consideration: IR.ABZUMS.REC.1398.096.

Results

Based on the results presented in this study, a total of 42 participating students, 78.6% ($n = 33$) was male and 21.4% ($n = 9$) was female. The mean year of students was 19.47 ± 0.7 years. Demographic information are shown in Table 1. There is no relationship with age, sex between groups. *T*-test showed no significant difference. Between groups in age and sex ($P = 0.71$, $P = 0.66$). The student's average mean was 17.02 and 16.89 in Groups A and B, respectively. There are no statistically significant differences in this parameter from Groups A and B ($P = 0.07$). Study time means in a day was 42.23 and 47.85 min in Groups A and B, respectively. The results of the *t*-test showed no significant difference ($P = 0.41$). However, the results indicated statistically significant correlations for study times

and post intervention scores in A and B groups ($r = 0.4$, $P = 0.07$, $r = 0.43$, $P = 0.04$). Pearson's correlation coefficient showed that the student with the highest average means to have a high score in pre- and post-intervention ($P < 0.001$). The results of pre/post-test mean scores and also comparing groups are shown in Table 2.

Table 2 shows no significant difference between students' scores in both the groups before intervention. The groups showed improvement when their posttest scores were compared to pretest scores. Both learning methods led to increase students' knowledge scores. The comparison between the two groups shows there was a significant increase in scores in Group B (mobile App) more than Group A (flashcard) in the post training intervention. In the evaluation of student's satisfaction, the mobile application was preferred by 84.28% of students. According to the Likert scale (1-5 point), Student's satisfaction divided into 0% very poor, 0% poor, 0% moderate, 11.9% good, and 88.1% very good. Advocates of using mobile mentioned advantages of mobile application and disadvantage of flashcards in the open-ended section of the questionnaire include; innovative, effective feedback, interest in keeping and forgetting about taking the flashcards and losing them. In contrast, Advocates of using flashcards pointed to the user tiredness to focusing on a smart mobile device screen, and have more fun in reading print-based texts.

Discussion

According to this study, there was a significant difference in a pre and post score about both methods. The mean score increased in the flashcard group from 11.85 to 16.25 that Consistent with the results of the study by Schmidmaier *et al.*,^[16] Taveira-Gomes,^[17] Eslahcar Komachali and Khodareza^[4] Golding *et al.*^[18] They showed a significant difference in using flashcard. Hence, it can be concluded that a flash card is a good idea for improving memory.

Furthermore, based on the results presented in this study, there was a significant difference in a pre and post score in the mobile learning group. The mean score increased in the mobile group from 11.78 to 17.38. The result has been shown this educational system can be utilized to improve the learning efficiency of students. Studies carried out by the Fesharakinia *et al.*,^[19] Moradi and

Table 1: Demographic information

Group	Flashcard			App			P
	Mean±SD	Maximum	Minimum	Mean±SD	Maximum	Minimum	
Age	19.52±0.7	21	19	19.42±0.6	21	19	0.71
Average	17.02±1.2	19.01	14.78	16.89±1.02	19.05	15.25	0.07
Study time (min)	42.23±11.2	60	30	47.85±9.02	60	30	0.41

SD=Standard deviation

Table 2: Comparison of pre- and post-test scores

Group	Flashcard			App			P
	Mean±SD	Maximum	Minimum	Mean±SD	Maximum	Minimum	
Pre	11.85±1.5	14	8	11.78±1.3	13.5	9	0.87
Post	16.21±1.2	18.5	14	17.38±1.1	19	15	0.003
P	<0.001			<0.001			

SD=Standard deviation

Didehban^[20] are consistent with the findings of our study. On the other hand, in contrary to study of Chase *et al.*^[21] who was internet dependence and considered as a major limitation in their study, our application was free from this limitation with offline usability and easily usable.

Comparing two learning methods, the result of this study showed that the post mean scores in mobile-based training group were significantly higher than the flashcard training group ($P = 0.003$). Although no study was found to compare these two methods with our study, in the form of comparing mobile-based training with other training methods, the studies carried out by Papzan AAH and Soleymani Adel,^[15] Salmani *et al.*,^[22] Briz-Ponce *et al.*,^[23] and Sargeran *et al.*^[24] studies and this was consistent with the findings of our study. Another aim of this study was a comparison of Students' satisfaction with two methods. According to this study, >84.28% of students were satisfied with the mobile as the availability of learning tools. Published articles concerning the characteristics of third-millennium students indicate that the current generation easily communicates by the image-rich environment. They try to make learning by themselves. However, using a mobile can be a step forward in improving this approach.^[16] The result of this study is consistent with Khosravi *et al.*,^[25] Kumar^[2] and Koohestani *et al.*^[26] Studies. Khosravi *et al.* expressed that Students' attitudes toward learning are more about the use of mobile phones as an educational tool. In addition, Komer *et al.*, expressed the mobile is fast tools and new opportunities, with the flexibility of time and space. Koohestani *et al.*, announced medical students have a positive attitude toward mobile learning. Furthermore, the analysis of the relation between student characteristics and scores after intervention indicated there was a significant direct relationship between students' mean hours of study, and their semester average with postintervention scores ($P = 0.001$). In the both groups, the students with high study hours and high average get a high score. However, Chase *et al.*^[21] found no significant relationship between study time and student scores in their study, but they believed that students' understanding has increased.

Conclusion

Given the effectiveness of using both methods (flashcards and mobile application), It is recommended that these

methods especially mobile application be used for surgical instruments education. The mobile application has an effective feedback in learning.

Limitation and suggestion

Despite teaching the students about not using the other group's teaching devices, students may have violated this law.

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Conflicts of interest

There are no conflicts of interest.

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