Original Article

The Impact of Teaching based on Animation Technology in Learning Anatomy Course of Pharmacy Students of Tehran University of Medical Sciences

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[DOR: 20.1001.1.22519521.1400.14.43.2.8]
[DOI: 10.52547/edcj.14.43.31]

Article Info

Article history:
Received 02 Dec 2020
Accepted 18 Feb 2021
Published 10 Nov 2021
Keywords:
Educational Animation
Knowledge
Attitude
Students
Pharmacy
University

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Abstract

Background & Objective: Animation can recreate events that are difficult to show in the real world or visualize in the mind. so, it seems to be useful in teaching courses such as anatomy, which has many intangible concepts.

Materials & Methods: This study was quasi-experimental. The statistical population included pharmacy students who were randomly substituted in two groups of 30 experimental and control using a random number table. The experimental group was trained in the circulatory and urinary systems in the form of animation and the control group was trained in lecture using the lecture method, which is the common method of teaching these articles. The level of learners 'knowledge was assessed through a researcher-made test based on the table of objective-content characteristics as pre-test and post-test and students' attitudes were assessed through a standard user satisfaction questionnaire.

Results: The usage of animation had a positive effect on the knowledge and attitude of pharmacy students and there was a clear difference between the mean points of the experimental and control groups in the post-test with a 95% confidence level. Based on analysis of covariance, at the knowledge level, the effect size was estimated to be 0/38 and at the Attitude level, this value was estimated at 0/40.

Conclusion: Using animation in teaching anatomy course in the field of pharmacy, a new structure and showing content related to the circulatory and urinary systems in the form of two-dimensional moving images, and performing various skills include showing the correct method and location of incision in dissecting organs and creating better visualization of the subject matter, will increase the knowledge and attitude of pharmacy students.

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Introduction

In the century of information technology and communication development, It is quite obvious to use devices and methods for teaching and learning processes (1). Especially when there aren't enough facilities, workshops, and laboratories for direct experience of learners or learners' mental understanding and perception of abstract and inaccessible topics, the usage of educational media can be helpful (2). According to psychologists, including Bandura, observational learning is the most sustainable and effective type of learning. Among the educational media, the animation is expanding day by day as visual and theatrical media independently or in combination with other social media. The comprehensive expansion of this media in the latest two decades shows the comprehensive acceptance of the audience of this media (3).

This method can be useful for understanding biological processes, natural phenomena, etc. (4). Animation training brings higher learning achievements than fixed image training (5). There are also different styles such as visual and auditory learning, and studies show that learning will be greatly influenced by the processes of multisensory presentation (visual and auditory) (6). In general,

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[DOR: 20.1001.1.22519521.1400.14.43.2.8]

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medical courses have many intangible complexities and concepts, and animation is one of the things that makes these concepts understandable to the audience (7). Medical education, which is important to the role in human health, must adapt to changes in new technologies (8). Studies shows that new technologies, changes in service delivery, emphasis on effectiveness and efficiency, and changing career plans are some of the challenges that the medical profession faces in the 21st century and that medical education must address (9). Medical training programs should be designed and implemented to train efficient physicians, and in this regard, learning clinical skills has been emphasized.

Educational animation in medicine has been formed since the 1960s and its main application has been to help mental visualization (9). It is different in the amount of learning in medical courses in different people depends on their previous knowledge in this subject, and the power of mental visualization and using educational tools (10, 11). Animation is used as a way of learning in medical students such as pharmacy (12, 13). Research has shown that mental visualization in anatomy education can be effective in students' learning and memory (14).

The usage of animation as a way of learning is to increase through medical students worldwide, And evidence of this claim published studies in references such as the MED portal and the library of health sciences. In the last half-century, the knowledge of pharmacy and its services around the world has witnessed extensive qualitative and quantitative changes. It is necessary to keep up with these developments, timely and appropriate changes in the pharmaceutical education system, such as the usage of new technologies such as animation (14). The field of pharmacy is planning to solve drug-related problems and health at the national level, prevention of toxicity and side effects of drugs and drug information, full knowledge of the characteristics of drugs in pharmaceutical pharmacopeia and patient guidance and physician advice on the proper usage of drugs and others Medication-related issues are involved, For this reason, pharmacists need to know the anatomy of the basic level, muscles and nerve cells of the upper limbs, or in similar cases, drug metabolism cannot be learned completely without even a basic understanding of the anatomy of the limbs (16). In this regard, according to the instructions of the Ministry of Health, Treatment and Medical Education of Iran, approved by the sixty-fourth session of the High Council for Medical Sciences Planning on 21/6/95, one of the courses of the Ph.D. in Pharmacy is anatomy (15)

Part of the histology course and description of pharmacy is related to two important organs of the body, it is called the heart and kidneys, which includes understanding the processes of the circulatory system and urinary system in the body and recognizing the external and internal parts of its organs. Based on mentioned points, including an acceptable level of knowledge in this field has a great impact on the future career of pharmacists. These subjects are among the courses in the field of medicine whose concepts are invisible and require strong visualization, so the animation can help this process (11).

On the other hand, we are dealing with new generation or Z generation students. A generation that is immersed in technology (17) .Therefore, it seems to be that if we ignore the educational technology for them, this generation will distance itself from education. It is considered that motivating learning, combining operational and practical topics is one of the most important issues that has been emphasized by the Ministry of Health in reviewing the teaching method of university medical courses (18), this gap is felt to require more effort and research to be used in universities.

A review of the texts show that most of the research done in the country on the effect of animation on learning on students has been done and less attention has been paid to students. Due to

the importance of this research and the shortcomings in this field, the researchers decided to study the effect of animation on the knowledge and attitude of students in one of the fields related to medicine, namely pharmacy, in the circulatory and urinary systems. If the animation has a positive effect on the above, it will try to eliminate this gap and make it operational.

Research method

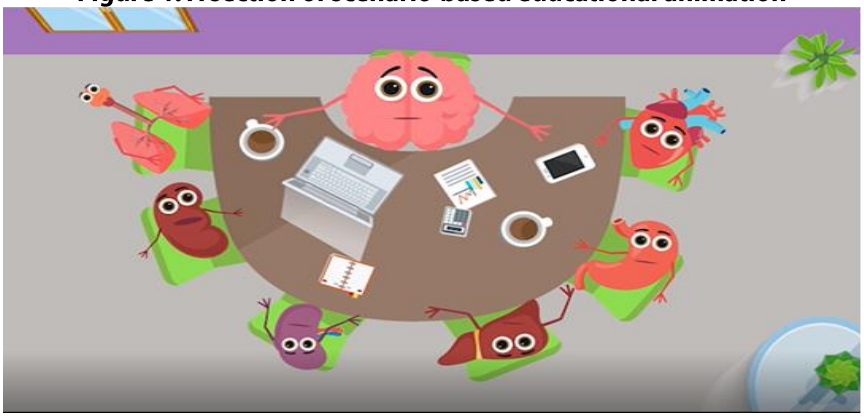
This research was applied in terms of purpose and quasi-experimental in terms of method and was conducted using a pre-test-post-test design and two experimental and control groups in 2019. The study population consisted of 60 pharmacy students of Tehran University of Medical Sciences who after a pre-test using a random number table were randomly divided into two groups of 30 experimental and control. Inclusion criteria were the choice of anatomy course in the semester. Students also entered the study based on personal desire and with informed consent, and students who were absent from one or more sessions on these topics were excluded from the study. In this study, none of the students found exit criteria.

The experimental group taught the circulatory system (heart) and urinary system (kidney) in the form of animation and the classroom with the presence of the teacher and the control group taught the same topics without watching the animation and only using the lecture method by the same professor. They were trained. The scientific content of the animation was prepared based on the authoritative book Grey's Anatomy and under the supervision of the director of the anatomy department of Tehran University of Medical Sciences, and its scenario and script were approved by several anatomists. After that, the electronic content production team and technical and educational specialists based in the virtual faculty of Tehran University of Medical Sciences prepared the content. Validation and quality control were performed under the supervision of the Virtualization Vice-Chancellor of the Virtual Faculty of Tehran University of Medical Sciences.

The duration of the animations varied from 2 to 20 minutes. . The animations were two-dimensional and non-interactive. The content output was in MP4 format and students could view it many, many times. Also, all content was produced based on George Ruiz's (19) educational animation standards table. All instructional content is scenario-based and does not go directly into the subject matter. In this way, at first, some important organs of the body that had found a human personality gathered around a table and briefly introduced themselves. then the heart and kidneys became the central theme of the animation.

Figure 1 shows a view of this fact.

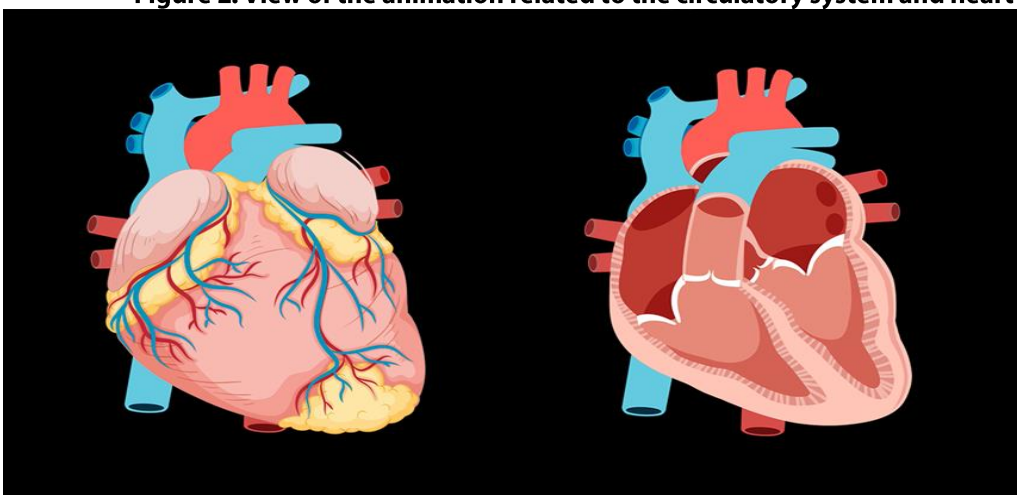
Figure 1: A section of scenario-based educational animation



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All items related to the research, including accurate and sufficient information, the confidentiality of the information, and the possibility of leaving the research were observed at each stage.Figure (2) shows a cross-section of the circulatory system teaching animation.

Figure 2: View of the animation related to the circulatory system and heart



Materials and Methods

At first, teaching methods in 10 sessions in the form of an approved lesson plan were carefully designed. Then, before and after the training course, pre-test and post-test were taken from both groups. A score of ten was considered for each test.

Research tool: To assess the knowledge of learners, with the cooperation of the relevant professor, a researcher-made test based on the table of purpose-content specifications was prepared and adjusted as a pre-test and post-test . The pre-test and post-test questions were the same and the reason for performing it in the pre-test was to ensure the balance of knowledge of the research participants. The questionnaire questions were designed and developed according to different levels of Bloom, which included 10 test questions. A curriculum-based knowledge assessment test was developed and approved by 5 expert professors. The reliability of the instrument was calculated by performing a retest test on previous incoming students and 60 people and the number was 0.760. These questions were used consecutively during the last few semesters in the faculty and were the property of accepting or rejecting students in the relevant course.

Students' attitudes were assessed through a standard questionnaire for user Interaction Satisfaction (QUIS)(20), pre-test, and post-test. The validity of this questionnaire was confirmed by 10 professors of medical education and curriculum and its reliability was obtained through Cronbach's alpha method of 0.879. The questionnaire contained 30 questions and 2 sections, the first part of which included 3 questions about the demographic characteristics of the participants, including age, gender, and level of interest in cartoons, and the second part included 27 questions related to the field of attitude. The questions in this area in the questionnaire were designed based on the Likert scale and in each question, the answers were rated from 1 to 5 (strongly disagree to strongly agree).

Statistical analysis of data

Describing the data, central indicators such as average and standard deviation were used, and to evaluate the normality of variables, Kolmogorov-Smirnov test, Levin test for homogeneity of variance in two groups and to obtain answers to covariance

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analysis (ANCOVA) research questions using the software. SPSS 24 was performed.

Results

In this study, 60 pharmacy students of Tehran University of Medical Sciences have taken, ranging in age from 18 to 26 years, and 36 (60%) were female and the remaining 24 (40%) were male. Table 1 shows the average and standard deviation of knowledge and attitude levels before the test.

Table 1: Mean and standard deviation of knowledge levels, attitude in pre-test

control group		experimental group		
standard deviation	Mean	standard deviation	Mean	Learning level
1.85	2.43	1.31	2.27	**knowledge**
15.45	52.60	15.43	45.90	**attitude**

The results show that the average score at the two levels of knowledge and attitude in the experimental and control groups is not significantly different. The findings of Table 2 show the results of educational programs in two groups after training.

Table 2: Mean and standard deviation of knowledge levels, attitude in post-test

control group		experimental group		
standard deviation	Mean	standard deviation	Mean	Learning level
1.97	4.57	1.76	6.93	**knowledge**
13.38	82.97	11.37	100.20	**attitude**

The average score of knowledge in the intervention group was 6.93 and in the control group was 4.57 and the scores related to attitude were 100.20 and 82.97, respectively. Using the analysis of Table 3, the significant value in the above test is greater than 0.05, and therefore the null hypothesis in the Kolmogorov-Smirnov test indicates that the data follow the normal distribution.

Table 3: Data normality test

sig	Kolmogorov-Smirnov Test	Mean and standard deviation	Type of test
0.051	1.35	2.35±1.59	**Knowledge pretest**
0.56	0.78	49.25±/15.67	**Attitude pretest**
0.14	1.14	5.75±2.20	**Knowledge posttest**
0.73	0.68	91.58±/15.06	**Attitude posttest**

Table (4) shows that the variance of the two groups is homogeneous. Therefore, according to the table Sig, which is greater than 0.05, the null hypothesis is confirmed.

Table 4: Homogeneity of variances

Sig	df2	df1	Levene Statistic	
0.84	58	1	0.04	**Knowledge pretest**
0.34	58	1	0.91	**Attitude pretest**
0.43	58	1	0.60	**Knowledge posttest**
0.89	58	1	0.01	**Attitude posttest**

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Table (5) also shows the interaction between the independent variable and the covariate, which is not significant, and therefore it can be concluded that the null hypothesis is accepted and the assumption of homogeneity of the regression slope is observed.

Table 5: Interaction between independent and co-variable

Sig	F	Average of squares	df	Total squares	Source of changes
0.226	1.502	3.821	1	3.821	Variable * Knowledge
0.184	1.808	243.144	1	243.144	Variable * Attitude

The first hypothesis of this research: The use of animation in education affects the education of pharmacy students of Tehran University of Medical Sciences.

Based on the results of analysis of covariance in Table (6) after removing the pre-test effect, there is a significant difference between the mean scores of knowledge level between the experimental and control groups in the post-test (P = 0.000) and the research hypothesis with 95% confidence level confirmed. It becomes. The effect size of this variable was 0.38, which indicates the mean effect.

Table 6: Results of analysis of covariance

Effect size	Sig	F	Average of squares	df	Total squares	Source of changes
0.280	0.000	22.176	56.922	1	56.922	pretest
0.384	0.000	35.541	91.229	1	91.229	group
			2.567	57	146.311	Error
				60	2271.000	Total

The second hypothesis of this research: The use of animation in education affects the attitude of pharmacy students of Tehran University of Medical Sciences.

Based on the results of the analysis of covariance in Table (7) after removing the effect of the pre-test, there is a significant difference between the mean scores of the attitude of the two experimental and control groups in the post-test (P = 0.000). Educational animation has affected the knowledge and attitude of students .Also, the effect size of this variable was 0.40.

Table 7: Results of analysis of covariance

Effect size	Sig	F	Average of squares	df	Total squares	Source of changes
0.131	0.005	8.571	1168.797	1	1168.797	posttest
0.404	0.000	38.591	5262.535	1	5262.535	group
			136.368	57	7772.970	Error
				60	516647.000	Total

Discussion

This study aimed to investigate the effectiveness of using educational animation on the knowledge and attitude of pharmacy students of Tehran University of Medical Sciences. The results showed that these two variables were significantly

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increased in pharmacy students in the experimental group compared to the control group. These results indicate that education through animation, which is one of the educational technologies, has a great impact on better understanding the location of different parts of the body and increasing the accuracy of cutting and thus increasing the level of knowledge of students. The results of this study can be considered in line with the results of the research of Alhayek et al. (2018) on the effect of animation on the oral education of Saudi students (20). Also, the results of the present study can be considered in line with the results of similar research in this field (2, 4, 7, 9, 20). Animation-based learning, by involving different senses, especially students' visual and auditory senses, and a better understanding of anatomy content, increases learning and increases the written scores of pharmacy students in the field of education in both circulatory and urinary systems. It becomes. On the other hand, the results of Saripudin et al. (2018) showed that the use of macro flash animation media as a simple tool can improve the overall motivation and progress, both now and in the future, which is in line with this research. (21) . Wang et al. (2018) also believe that in animation, the amount of eye focus will increase and as a result, the amount of learning will increase a lot (22). The results of research by Lowe, Ikwuka, Hatami, and Nansinguza (2017) also point to the same issue (10, 23, 24, and 25). The results of this study can be considered in line with the results of Berney and Bétrancourt (2016) who state that animation can greatly increase the rate of learning (5). Its results are also consistent with the results of research by Issa et al., Which shows how multimedia can be effective in learning knowledge, changing attitudes, and gaining performance in medical students (26).

In general, it can be said that new multimedia such as animation can change the learning environment and make it attractive and attract learners to the learning process . They also inject reinforcing stimuli into the process of teaching and learning, and increase the motivation of learners and strengthen the positive attitude of students in this field, in learning the relevant topics, and ultimately lead to the development of attitudes.

Using animation in teaching anatomy courses in the field of pharmacy, using the new structure and displaying content related to the circulatory system and urinary system in the form of two-dimensional moving images and displaying various skills in educational animations such as showing the correct method and location of incision in explaining organs The body and creating a better visualization of the subject of the lesson, will increase knowledge and awareness and promotion, as well as the interest and motivation of pharmacy students and get better grades in the relevant exams.

Conclusion

Teaching learners specific knowledge, attitudes, and skills are one of the aims of using information and communication technology. The results showed that the usage of animation, by using the new structure and showing content related to the circulatory system and urinary system, increased the knowledge and awareness of pharmacy students and obtained better scores in the relevant tests. It is hoped that the results of this research can help promote and improve the concepts and issues in the field of medical sciences.

This study was conducted only on students of the Faculty of Pharmacy, which should be careful in generalizing the results to the student community. On the other hand, it was done only in one university and it was better to be performed in several universities. The variables of age and gender in the study were considered in two groups so that both groups are homogeneous, but the amount of access to technical facilities, location, urban and rural status, or previous grade point average of students wasn't considered, which can affect the results. It is suggested that in the future, research be conducted on topics such as the effect of using

educational animations on students' learning in other fields of study and the effect of using educational animations on teaching motivation.

Ethical considerations: This article is taken from the master's thesis and is registered with the code IR.IAU.TNB.REC.1399.032. The participation of volunteers was voluntary and informed consent was obtained. All items related to information confidentiality and anonymity and grades obtained by students were included in the tests. The research has no sponsorship and all costs related to content creation are paid by the researcher.

Conflict of interest

There is no conflict of interest in the present study by the authors.

Aknowlegment

This research is part of the research work of the master's thesis with the cooperation and assistance of respected professors of the Department of Anatomy, Tehran University of Medical Sciences, especially Dr. Hassanzadeh, professor of this field who spent a lot of time and energy and supported us throughout the research. we sincerely thank the students who participated in this research and motivation ffor participating in the various stages of this research.

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