

Effect of Game-Based Learning on Students' Retention of Knowledge among Undergraduate Medical Students

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Abstract

Background: Successful medical education is essential for medical students' professional proficiency. Interactive teaching strategy helps the medical undergraduates better understanding in dynamic way. One of the most important goal of this teaching method is to create an environment which promotes students' motivation and interest and thus facilitates learning. The aim of this study was to assess medical students' retention of knowledge using game-based learning method.

Materials and methods: This experimental study was conducted in the Department of Physiology, Chittagong Medical College and Institute of Applied Health Science, Chattogram. Total 126 apparently healthy 1st year medical students were included in this study by stratified random sampling. All students were undergone a pre-intervention test to measure their baseline knowledge on the chosen content. Then they were randomly allocated into experimental and control groups by lottery method. Traditional lecture-based learning (TLBL) was used for teaching in the control group and game-based learning (GBL) method was used in the experimental group. Just after implementing two teaching methods, a post-intervention test was done in both groups to measure their knowledge achievement. A retention test was arranged after two weeks to assess the students' retention of knowledge, in which 59 students in experimental group and 63 students in control group participated.

Result: Retention test data of 59 students of experimental and 63 students of control were analyzed and compared between the groups. Results were analyzed by Statistical Package for Social Sciences (SPSS) version 26.

Conclusion: This study concluded that game-based learning may be more effective learning tool in retention of knowledge among undergraduate medical.

Key word : Game-Based Learning (GBL); Pre-intervention test; Retention test; Traditional Lecture-Based Learning (TLBL).

Introduction

Over the last few decades, learning environment has transformed into more student-centered where students learn actively rather than just receiving information.^{1,2} Students may experience stress from complex content of medical education, which is associated with poor attention and memory deficit.³ Interactive teaching strategy helps the students in deep learning in interactive way and promotes achievement of knowledge.⁴ Game based learning is a dynamic and interactive method in teaching/ learning process in which learners participate in a competitive way.³ In this learning approach, there is incorporation of specific game ideas and features into traditional method in order to engage students in a fun and dynamic process. It is not only making games for students to play; it rather establishes learning activities that gradually introduce students with new concepts.⁵ According to Gee's study, game-based learning increases intrinsic learning motivation, emotional involvement and enjoyment which are important for learning.⁶ Game based learning can provide greater dynamism and participation and interaction among students and increase knowledge retention.³ On other hand, traditional lecture-based learning is the oldest and common method of teaching in which learners passively receive information delivered by teacher.^{3,7} In view of the benefits of game-based teaching, this study aimed to evaluate the effect of game-based learning on students' retention of knowledge among undergraduate medical students.

Materials and methods

This experimental study was carried out from January 2024 to December 2024 in the Department of Physiology, Chittagong Medical College and Institute of Applied Health Science (IAHS) Chattogram, Bangladesh. After obtaining ethical approval, permission was obtained from

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the Principal of the respective institutes for conducting the study. Total 126 students were included from both institute (CMC:80 and IAHS:46) by stratified random sampling. The students were assured that they could withdraw themselves from the study if they wish and participating in this study would not affect their grades and evaluation in any way. Information regarding demographic information, general health and history of present and past illness was taken from study subjects by interviewing. Information was recorded in data collection form and an ID number was given to each subject.

Inclusion criteria (For both group):

- Apparently healthy 1st year medical student.
- Voluntarily willing to participate.

Exclusion criteria (For both experimental and control group)

- H/O Acute illness.
- H/O psychiatric illness, anxiety disorder.

The selected topic of discussion was announced two weeks in advance. Participants were instructed to gain knowledge regarding the topic from the textbook on medical physiology and also from internet and other source. Before implementation of game and lecture method, a pre- intervention test was conducted to measure their baseline level of knowledge in selected topic.

Based on the learning and teaching method, participants were randomly divided into experimental and control group by lottery. Game based teaching-learning was implemented to experimental group and traditional lecture- based teaching-learning was delivered to control group. Students assigned to the game-based learning were divided into 5 sub-groups.

There were four sessions in game-based learning: MCQ round, explanatory type round, rapid fire round and image-based round.^{8,9,10}

In MCQ round, 5 MCQ questions (One for each team) were shown in power point projector in the classroom in full view and they had to answer each question verbally.

In explanatory type round, there were explanatory and applied type questions in paper chit and students of each team explained these 2 questions in 1 minute.

In rapid fire round, 10 short answer type questions were shown in the power point projector for each team and they had to answer the questions verbally in 2 minutes.

In image-based round, 5 image-based questions included figures, diagrams and applied aspects were shown in power point projector. Each question had to be answered verbally in one minute.

At the end, the team with the highest score received a token gift.

At the same day, students assigned to traditional lecture group received a lecture using power point projector, where a teacher delivered her lecture on the same topic of game- based learning. After implementation of both teaching method, a post-test was taken with the same question of pre-test. After 2 weeks, a retention test was conducted to assess the students' retention of knowledge, in which same questions of pre-test and post-test were used. 4 students of experimental group were absent in retention test. Finally, 59 students in experimental group and 63 students in control group participated in retention test.

After collection, data were compiled in Microsoft Excel sheet to generate a master sheet. Next, they were fed into Statistical Package for Social sciences for processing and analysis.

Results

Table 1 Comparison of the retention test score between experimental and control groups

Variables	Experimental Group (n=59)	Control Group (n=63)	p value (t value)
	Mean $\pm$ SD	Mean $\pm$ SD	
	(Range)	(Range)	
Retention test - score	7.62 $\pm$ 0.88 (5.60 - 9.40)	7.09 $\pm$ 0.84 (5.20- 9.00)	<0.001* (t=3.378)

Unpaired student's t test was done to compare the retention test scores between experimental and control group.

Table I shows the mean value of retention test score was significantly higher in the experimental group than the control group.

Table II Comparison of Retention-test scores between experimental and control groups among female students

Scores	Experimental	Control	p value
	Group	Group	(t value)
	n=25	n=38	
	Mean $\pm$ SD	Mean $\pm$ SD	
	(Range)	(Range)	
Retention score	7.47 $\pm$ 0.96 (5.80 - 9.00)	7.31 $\pm$ 0.87 (5.20 - 9.00)	0.512 (t=0.660)

Unpaired student's t test was done to compare the retention test scores between experimental and control group among female students.

Table II shows there was no statistically significant difference in the mean value of retention-test scores among female students between experimental and control group.

Table III Comparison of Retention-test scores between experimental and control groups among male students

Scores	Experimental	Control Group	p value
	Group n=38	n=25	(t value)
	Mean $\pm$ SD	Mean $\pm$ SD	
	(Range)	(Range)	
Retention score	7.73 $\pm$ 0.82 (5.60 - 9.40)	6.77 $\pm$ 0.69 (5.20 - 8.20)	<0.001* (t=4.757)

Unpaired student's t test was done to compare the retention test scores between experimental and control group among male students.

Table IV shows the mean value of retention test score was significantly higher in the experimental group than the control group among male students.

Discussion

To check the level of knowledge retained by the two groups, a retention test was conducted after 2 weeks in our study and their test scores were compared to observe the effect of Game- Based Learning (GBL) method. The result showed the game-based learning group had significantly higher retention test-scores than the lecture group (Table I) indicating the quiz game method played important role in retention of information. Similar finding was also observed in previous study.^{4,8} Both studies found that recall of knowledge were significantly better in the game-based learning group than the lecture group. According to their study, this specific game format helped the

students to retain the information better and made it easier to recall. In game-based learning process, questioning promotes critical thinking and improves subsequent test scores and grades.⁹ This strategy enables the participants to review the contents and helps the students to retain knowledge.³ Learner performance in sequential cognitive domains such as memory, understanding, and idea application can be enhanced by educational gamification.⁵

Analysis of retention test-scores among male and female students showed no significant difference in test scores between experimental and control group among female students but significantly higher retention-test scores were observed in experimental male students (Table I,II). The result suggests male students learned better by game-based teaching-learning method. Some researchers found there was no significant association between gender with higher or lower test scores.⁵ Afonso et al. reported that active teaching strategy aids the students to memorize the content dynamically and thus improve academic performance because this method reinforces learning.³ Different studies on students perception regarding teaching strategy documented students' improvement in performance through active teaching-learning processes.⁹⁻¹³

The outcome of this study revealed game-based teaching had overall more effective role for better knowledge retention among undergraduate medical students. It is hoped that application of game-based learning helps to create active and enjoyable learning medium for students which can foster the interest of students in learning.

Limitation

- The study involved only 1st year MBBS students.
- This study was conducted with small sample size.
- This study was conducted only in two medical colleges. This might not be a proper representation of the total population of Bangladeshi medical undergraduates.

Conclusion

From the results of this study, it can be concluded that game-based learning may be more effective learning tool in retention of knowledge among undergraduate medical students because learning can be made enjoyable and exciting through game-based learning, which can inspire and motivate students to enrich their knowledge.

Recommendation

Similar study can be done by including MBBS students of all years of CMC and with a large number of medical colleges in order to make the study more representative of the country.

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Contribution of authors

FA-Design, acquisition of data, data analysis, interpretation of data, drafting & final approval.

SA-conception, design, interpretation of data, critical revision & final approval.

BU-Data analysis, interpretation of data, critical revision & final approval.

DB-Acquisition of data, data analysis, drafting, critical revision & final approval.

Disclosure

All the authors declared no competing interest

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