EFFECT OF EDUCATIONAL GAMES ON LEARNING PROCESS IN II-YEAR MEDICAL STUDENTS STUDYING PATHOLOGY- A HOSPITAL BASED PROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

Games designed for serious purposes rather than just entertainment are gaining worldwide attention as they allow players to learn new skills and knowledge, stimulate physical activities, or enhance social-emotional development. These games are widely applied within the educational field to facilitate medical students' learning through the integration of information in a competitive active environment. It can support higher-level discussions that assist in enhancing medical students' communication, social collaboration, and critical-thinking skills, all of which are abilities essential to the future doctor. Despite of the advantages of games in the health care field, the evidence of their pedagogical effectiveness is still in question.

METHODS

All 148 students were taught various topics in pathology by power point presentations during lecture hours. For the whole batch a pre-test was conducted using 50 multiple choice questions. Later on, for tutorials, students were divided into two groups (A and B) of 74 each. Group A (control group) was subjected to the traditional tutorials of having question / answer session and clarifying student doubts. Group B (experimental group) were exposed to "Educational Games" like playing cards, puzzles, etc. At the end of the three topics in pathology (within a span of two months), all the students (both experimental group and control group) were subjected to an examination (post-test) (same paper) having 50 multiple choice questions. Analysis of results was done with the case and control groups and level of significance was calculated. Pre-test and post test results were also analysed. Later on, perception of students was undertaken by giving them a questionnaire regarding the effect of educational games on medical students' satisfaction, knowledge, attitude and skills.

RESULTS

Group wise analysis of motivational levels based on post-test score (Experimental Group vs. Control Group) (both topics) was done. The significant t-value in the post tests indicates that the motivational levels of the experiment group are much more than the control group.

CONCLUSIONS

Game based learning (GBL) scenarios contribute to the improvement of skills, they provide a means for fun in the course, enrich the educational environment, encourages active participation, help structure the knowledge more easily, and contribute to the reinforcement of knowledge gained in the course.

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BACKGROUND

To be successful in higher education one must "learn to learn". Understanding the subject, critical thinking, analysing the issues and communication skills form the essential components of any ideal learning process.[1]

Curriculum packed with lectures and 'rote learning' hinders the student from acquiring these skills. However, making the student as active participant rather than passive listener (in lectures) can convert a student into a life-long learner.[1]

An educational game is "an instructional method requiring the learner to participate in a competitive activity with preset rules." Using games to instruct medical students has the potential to improve their learning and clinical performance.[2]

Games designed for serious purposes rather than just entertainment are gaining worldwide attention as they allow players to learn new skills and knowledge, stimulate physical activities, or enhance social-emotional development. These games are widely applied within the educational field to facilitate medical students' learning through the integration of information in a competitive active environment. It can support higher-level discussions that assist in enhancing medical students' communication, social collaboration, and critical-thinking skills, all of which are abilities essential to the future doctor.[3]

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Further, educational games allow educators to create real-life scenarios within safe environment without real-life consequences. Despite of the advantages of games in the health care field, the evidence of their pedagogical effectiveness is still in question. Also, potential difficulties arise with the strategy as some students may find the competition among peers threatening or anxiety-causing.[4]

Hence a prospective study was undertaken to assess the effect of active learning by incorporating "educational games" during tutorials in pathology for a group of II-year medical students and later on perceptions from II-year medical students will be undertaken to know its effect on imparting skills and knowledge.

General Objective

To assess, the effect of educational games on medical students' satisfaction, knowledge, attitude and skills.

Specific Learning Objectives

- To compare the knowledge gained by traditional tutorials and education-based games in medical students.
- To assess the effect of educational games on medical students' knowledge, attitude and skills.
- To find out the barriers in education-based games.

Hypothesis

- There are high chances that the students undergoing education-based games will have more knowledge than traditional tutorials
- There would be a significant improvement in the knowledge, attitude and skills after the exposure to the module.

METHODS

Study Design

Before and After Comparative study with Educational Intervention.

Study Period

The proposed study was conducted from 1st June 2018 to 31st July 2018.

Study Population

II-year Medical students of a Medical college.

Research Instrument

Sample Size

II-year medical students from our Medical college i.e., 148 students were the sample size (since we have only one batch of students in our medical college i.e., II-year MBBS students).

Data Collection

An informed consent was taken from those who agree to participate in this planned study. One hundred and forty-eight students of MBBS Year II, Semester III of our medical College are the subjects of this study.

All the 148 students were taught various topics in pathology by power point presentations during lecture hours. For whole batch a Pre-test was conducted using 50 multiple choice questions based on two topics (item analysis was done).

Later on, for tutorials, students were divided into two groups (A and B) of 74 and 74 respectively. Group A (control group) were subjected to the traditional tutorials of having question / answer session and clarifying student doubts. Group B (experimental group) were exposed to "Educational Games" like playing cards, puzzles, quiz, who want to be a millionaire, scrambles, rearrangement of facts etc.

At the end of the two topics in pathology (within a span of two months), all the students (both experimental group and control group) were subjected to an examination (Post-test) (same paper) having 50 multiple choice questions of graded difficulty based on must to know (70%), desirable to know (20%) and nice to know (10%).

Analysis of results was done with the experimental and control groups and level of significance was calculated. Pre-test and post test results were analysed.

Later on, perception of students was undertaken by giving them a questionnaire (Figure) regarding the effect of educational games on medical students' satisfaction, knowledge, attitude and skills.

No.	Group	Pre-test	Intervention	Post-test
1.	Experimental Group	√	√	√
2.	Control Group	√	.....	√

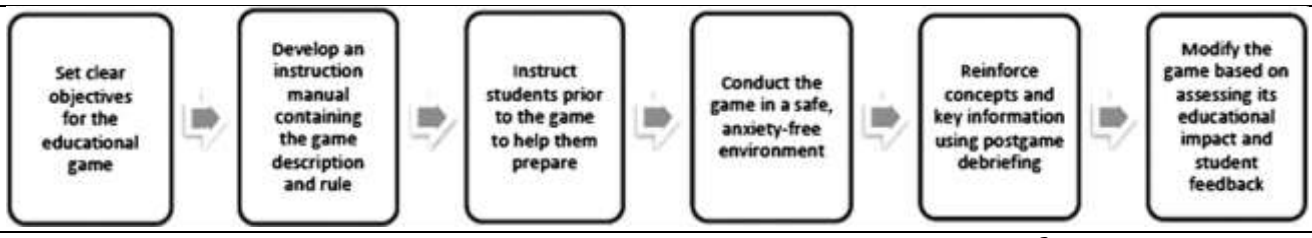

Figure 1. Descriptive Steps for Proper Educational Game Design[3]

Examples-

- **"Playing Card Type"- Viva-Voce Examination**
  - In which there will be 20 questions.
  - These questions were divided into Must to know, desirable to know and nice to know. Must to know questions will be accounted for 14 questions (70%), desirable to know will be accounted for 4 questions (20%) and nice to know questions will be accounted for 2 questions (10%).
  - Playing Cards were made for each question.
  - Student should pick 7 cards from a bunch of 14 cards of must to know, 2 cards from 4 desirable to know and one card from 2 nice to know.
  - Each card one mark and whole viva-voce was given 10 marks (So, Student picks 10 cards).

Figure 2. Playing Card Viva-Voce {M- Must to Know (14), D- Desirable to Know (4), N - Nice to Know (2)}

- **Cross Word Puzzle**

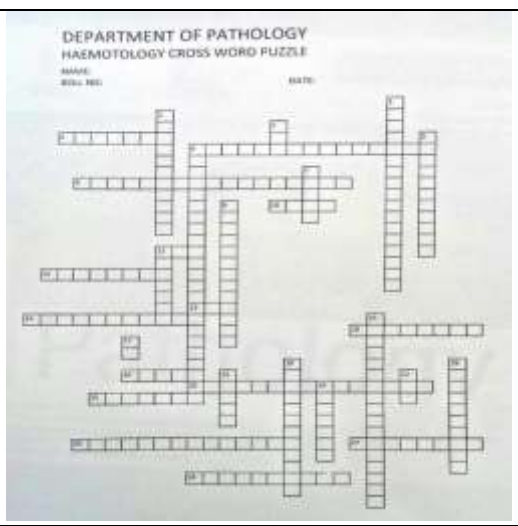

Figure 3. Cross Word Puzzle (Topic- Haematology)

Figure 4. Students Solving Cross Word Puzzle (Haematology)

Figure 5. Students Solving Cross Word Puzzle (Neoplasia)

Inclusion Criteria
Medical students who have signed the informed consent form were included in the study

Exclusion Criteria
Medical students who have not signed the informed consent form were not included in the study.

Data Analysis
Obtained data was checked for errors and then data entry was completed and finally data was analysed by using recent SPSS 11.0 software. Analysis of MCQ test results was done for both experimental and control groups and level of significance was calculated by using t test. Pre-test and post test results were analysed. Questionnaires were analysed to know the effect of educational games on medical students' satisfaction, knowledge, attitude and skills from experimental group students.

Ethical Consideration
The study protocol has been approved by the Institutional Ethics Committee. Each Participant was well informed about the aim and potential benefit of the study, their consent taken, and confidentiality ensured.

RESULTS
Hypothesis

- There are high chances that the students undergoing education-based games will have more knowledge than traditional tutorials
- There would be a significant improvement in the knowledge, attitude and skills after the exposure to the module.

Note: Out of 74 students, only 68 students attended both pre-test and post-test in experimental group, so 68 students were included, and 6 students were excluded, for the sake of calculation.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Pre-Test	68	38.21	9.79	3.40	0.91	10.64**
2.	Post-Test	68	48		4.79		

Table 1. Test Wise Knowledge and Motivational Difference of Experiment Group I (One Topic- Neoplasia)

** Significant at 0.05 and 0.01 levels.

Interpretation
As the t value is found to be significant it can be concluded that there is significant difference between the pre-test and the post-test which implies that the exposure to educational games has a significant effect in motivating the II-year MBBS students. Hence, the hypothesis is accepted.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Pre-Test	68	37.62	10.88	4.69	1.12	9.70**
2.	Post-Test	68	48.5		6.18		

Table 2. Test Wise Knowledge and Motivational Difference of Experiment Group II (Second Topic- Haematology)

** Significant at 0.05 and 0.01 levels.

Interpretation
As the t value is found to be significant it can be concluded that there is significant difference between the pre-test and the post-test which implies that the exposure to educational games has a significant effect in motivating the II-year MBBS students. Hence, the hypothesis is accepted.

Note: Out of 74 students, only 62 students attended both pre-test and post-test in control group, so 62 students were included, and 12 students were excluded, for the sake of calculation.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Pre-Test	62	37.10	0.3	3.54	0.84	0.36 NS
2.	Post-Test	62	37.40		4.76		

Table 3. Test Wise Knowledge and Motivational Difference of Control Group I (One Topic- Neoplasia)

NS: Not Significant.

Interpretation
As the t-value is not significant, it can be concluded that the traditional methods have no effect on the motivation of II-year MBBS students in learning Pathology.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Pre-Test	62	37.2	0.62	3.10	0.76	0.81 NS
2.	Post-Test	62	37.82		3.72		

Table 4. Test Wise Knowledge and Motivational Difference of Control Group II (Second Topic- Haematology)

NS: Not Significant.

Interpretation

As the t-value is not significant, it can be concluded that the traditional methods have no effect on the motivation of II-year MBBS students in learning Pathology.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Experimental	68	48	10.6	4.79	1.00	10.6**
2.	Control	62	37.40		4.76		

Table 5. Group wise Motivational Difference: (Experimental Group I vs. Control Group I) (Neoplasia Topic)

Interpretation

The significant t-value indicates that the motivational levels of the Experiment group, is much more than the Control group of II-year MBBS students with regard to motivation. Hence, the hypothesis is accepted.

Sl. No.	Test	Sample	Mean	Mean Def	S.D.	S. Ed.	t-Value
1.	Experi-mental	68	48.5	10.68	6.18	1.06	10.7**
2.	Control	62	37.82		3.72		

Table 6. Group Wise Analysis of Motivational Levels Based On Post-test Score (Experimental Group II vs. Control Group II) (Haematology Topic)

Interpretation

The significant t-value indicates that the motivational levels of the Experiment group, is much more than the control group of II-year MBBS students with regard to motivation. Hence, the hypothesis is accepted.

RESULTS

1. It is obvious that there is a significant improvement in the motivation levels of experimental groups than that of control groups, which did not receive the exposure to educational games.
2. As the t-value is found to be significant it can be concluded that there is significant difference between the pre-test and the post-test of the Experimental Group I which implies that the exposure to educational games has a significant effect in motivating the II-year MBBS students.
3. As the t- value is found to be significant it can be concluded that there is significant difference between the pre-test and the post-test of the Experimental Group II which implies that the exposure to educational games has a significant effect in motivating the II-year MBBS students.
4. As the t-value is not significant, it can be concluded that the traditional methods have no effect on the motivation of II-year MBBS students of control group I.
5. As the t-value is not significant, it can be concluded that the traditional methods have no effect on the motivation of II-year MBBS students of the control group II.
6. The significant t-value in the post tests indicates that the motivational levels of the Experiment group I is much more than the Control group I of II-year MBBS students with regard to motivation.
7. The significant t-value in the post tests indicates that the motivational levels of the Experiment group II is much more than the control group II of II-year MBBS students with regard to motivation.

Educational Implications

1. The tried-out package of educational games can be introduced and used for II-year MBBS students in motivating the pupils towards learning Pathology.
2. The tried-out package of educational games can be introduced for II-year MBBS students in learning Pathology easily in their syllabus.
3. The package of educational games will be useful for medical teachers in their program.
4. For low achievers the package would be a boon to improve their skills.
5. Medical colleges must focus on conducting workshops for teachers for orienting them about usage of educational games in teaching Pathology.

Pre-Validation of The Questionnaire

Pilot testing was done on 10 II-year MBBS students who were asked to opine regarding the content, consistency and clarity of the questionnaire. Necessary modifications were made as per the feedback given by the students.

- The pre-validated questionnaire based on 5- point Likert scales, ranging from strongly disagree to strongly agree was administered to the study sample to elicit their perceptions on the interactive sessions they had attended, after taking written informed consent and institutional ethical committee approval. Out of 153 II-year MBBS students, 136 students returned the questionnaire.

Reliability of The Questionnaire

The reliability of the questionnaire was done by calculating the Cronbach's alpha which showed the value of 0.901 indicating a highly reliable one.

Statement	N= 136	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Game based learning (GBL) scenarios contributed to the improvement of my skills	N	92	36	06	02	---
	%	67.64	26.47	4.41	1.47	---
2. GBL scenarios increased my self-confidence	N	40	88	08	---	---
	%	29.41	64.70	5.88	---	---
3. GBL scenarios boosted my motivation towards the subject	N	30	100	04	02	---
	%	22.05	73.52	2.94	1.47	---
4. GBL scenarios increased my interest in this course.	N	14	110	06	06	---
	%	10.29	80.88	4.41	4.41	----
5. GBL scenarios provided a means for fun in this course.	N	98	30	06	02	---
	%	72.05	22.05	4.41	1.47	---
6. GBL scenarios contributed to an enrichment in the educational environment	N	100	30	04	02	---
	%	73.52	22.05	2.94	1.47	---
7. GBL scenarios helped decrease the anxiety level of the class.	N	16	108	06	06	---
	%	11.76	79.41	4.41	4.41	---
8. GBL scenarios helped reinforce the knowledge gained in the course.	N	48	80	08	---	----
	%	35.29	58.82	5.88	---	----
9. GBL scenarios contributed to a better comprehension of the course's subjects.	N	30	102	02	02	----
	%	22.05	75	1.47	1.47	---
10. GBL scenarios helped us to actively participate in the course	N	98	30	06	02	---
	%	72.05	22.05	4.41	1.47	---
11. GBL scenarios helped structure the knowledge more easily	N	20	103	11	02	---
	%	14.70	75.73	8.08	1.47	---
12. I think that game-based teaching should be applied in other courses as well.	N	10	114	08	04	---
	%	7.35	83.82	5.88	2.94	---
13. I find game-based teaching practices boring	N	---	02	10	14	110
	%	---	1.47	7.35	10.29	80.88

Table 7. Student's Perception About Games Based Learning

DISCUSSION

According to Table 1, 67.6% of the student's stated completely agreement with the item, "Game based learning (GBL) scenarios contributed to the improvement of my skills" and 72% with the item, "GBL scenarios provided a means for fun in this course." Likewise, 73.5% also stated complete agreement with the item, "GBL scenarios contributed to enrichment in the educational environment" and 72% with the item, "GBL scenarios helped us to actively participate in the course."

In addition to this, the majority of participants chose the "I agree" option for the following items: "GBL scenarios increased my self-confidence." (64.7%); "GBL scenarios boosted my motivation towards the subject." (73.5%); "GBL scenarios increased my interest in this course." (80%); "GBL scenarios helped decrease the anxiety level of the class." (79.2%); "GBL scenarios helped reinforce the knowledge gained in the course." (58%); "GBL scenarios contributed to

a better comprehension of the course's subjects." (75%) and "I think that game-based teaching should be applied in other courses as well." (83%). These items are those upon which the student mostly agreed.

Thus, it can be concluded that just as Game based learning (GBL) scenarios contribute to the improvement of skills, they provide a means for fun in the course, enrich the educational environment, encourages active participation, help structure the knowledge more easily, and contribute to the reinforcement of knowledge gained in the course.

Sl. No.	Statement	Ruhan Karadag's Study[5] (Strongly Agree and Agree combined)	Our Study (Strongly Agree and Agree combined)
1.	GBL scenarios provided a means for fun in this course	87.3%	94.1%
2.	GBL scenarios contributed to enrichment in the educational environment	91%	95.5%
3.	GBL scenarios helped us to actively participate in the course	86.3%	94.1%
4.	GBL scenarios helped decrease the anxiety level of the class.	70.4%	91.2%
5	GBL scenarios helped reinforce the knowledge gained in the course.	89.9%	93.2%

Table 8. Comparing Our Studies Perception Regarding GBL with Ruhan K Study[5]

Moreover, students expressed positive opinions about having game-based classes. According to these results, using GBL scenarios makes the classes more fun, the content clearer, and the level of understanding higher. Furthermore, GBL scenarios also help turn theory into practice, encourages active participation, and eases the gain of knowledge and skills related to primary reading and writing instruction.

Comments from the student opinions on the use of GBL scenarios in classes are as follows: "We used to get bored in theoretical courses. However, GBL helped us to understand the content of the course and reinforce our knowledge. Because it was fun, almost everybody in the class participated in the activities.

We had the opportunity to turn theory into practice. GBL actually raised our awareness." The practices were very enjoyable. I participated in the activities. I didn't just listen, I applied them as well." By taking these results into consideration, it might be stated that using GBL scenarios will provide positive gains for students as well as for the teaching faculty.

In this study, a course was been designed to explain and explore students' perceptions toward GBL. The results of the study reveal that instruction based on the use of GBL scenarios increased their knowledge and skills.

Students also stated that it helped them to structure their knowledge easily, understand the content of the course better, and put theory into practice. In addition, the process helped to reinforce the information gained in the course by actively using it. They pointed out that as a result of the GBL scenarios, the course included more "fun" activities and promoted a rich learning-teaching environment.

Moreover, the results revealed that students enjoyed the course, expressing positive views regarding participating in GBL based classes. These results show similarities to those of the study conducted by Bayırtepe & Tüzün, which showed that students not only liked GBL, but also that GBL decreased students' anxiety levels. In addition to this, the study carried out by Tham & Tham revealed that university level students also enjoyed GBL.[5]

It also showed that GBL promoted motivation, an increase in collaborative learning, encouraged teamwork and socialization among students, and increased both interest and participation in the lesson; all of which are similar to the findings of the present study.

In a similar vein, the study by Meletiou-Mavrotheris & Mavrotheris, and Can & Cagiltay also showed that pre-service teachers exhibited positive attitudes toward using games in education and that they planned to use games in their teaching career. Furthermore, many other studies have argued that games provide learning through entertaining (Klawe; Pramling Samuelsson & Johansson; Sedighian & Sedighian).[5]

Students also believed that using GBL practices would produce positive outcomes. Attracting and maintaining students' attention, arousing interest in the course's content, combining fun and learning, establishing an environment conducive to reading and writing, providing feedback to the teacher, making the evaluation process easier, and ensuring retention of the knowledge learned in class were also stated as being among the benefits of using GBL. These results are parallel with those of the study conducted by Mavrotheris M and Mavrotheris,[6] which revealed that educational games have a positive impact on teachers' evaluation skills.

The results of this study further show that GBL based classes make positive contributions to the teaching-learning process. The students also stated that using GBL scenarios in classes promoted critical thinking, creative thinking, and evaluation skills especially during cross word puzzles.

In study done by Buch et al[7] students liked MCQs the most followed by brain storming and confusion technique, whereas in our study students liked the "Who want to be Millionaire game" (Quiz) the most followed by cross-word puzzle and Playing Card - Viva-voce.

Moreover, the results showed that doing so also helped them to gain professional teaching knowledge, increase their self-confidence levels, raise awareness, provide opportunities to see different classroom applications, instil a sense of responsibility, improve imagination skills, provide opportunities to put theory into practice, and develop motivation.

In the literature, numerous studies have been carried out to explore the effectiveness of educational games, all of which suggesting that games promote motivation, provide immediate feedback, reinforce the information gained, help the development of skills, caused changes in students' behaviours and attitudes (Rossiou & Papadakis).[8]

The study conducted by Meletiou-Mavrotheris & Mavrotheris[6] found that games helped pre-service teachers to learn through entertainment, increased motivation, promoted active participation, aroused interest in learners, and helped them learn the concepts easily.

In parallel with these results, the studies by Bakar et al., Cheng & Su, Dumitrache et al., Emin-Martines & Ney, Holmes, Pivec & Kearney, and Rossiou & Papadakis revealed that educational games promoted motivation and that students had positive attitudes toward such games.[5]

In addition to these findings in the literature, Frossard et al. also found that GBL increased creativity, improved collaboration and Egenfeildt-Nielsen stated that the use of GBL boosted students' creativity and active learning. Furthermore, Holmes found that GBL provided opportunities for repetition, feedback, and improved self-efficacy. However, the current study also showed that the pre-service teachers experienced some problems in the design process, the development, and use of GBL scenarios.

In the design stage of the GBL scenarios, the barriers most frequently faced cited were feeling anxious about the possibility of failing to prepare an age- and content-appropriate game, its being time consuming, and students' having insufficient time. In development stage of GBL scenarios, teachers' most frequently expressed challenge was feeling anxious about the possibility of failing. During implementation stage of the GBL scenarios, teachers not only stated feeling nervous before the presentation, and feeling anxious about not being able to maintain the class's interest and curiosity, but that that there was not sufficient time to present. Interestingly, Becker & Jacobsen also stated participants' perceived lack of time as well as technical issues to be the most significant barriers to using games in education.[5] and from student's point of view there were no barriers in GBL.

However, one of this study's limitations lies in the number of participants surveyed.

In addition, encouraging the use of GBL in different areas of education and supporting those studies promoting teachers to use GBL scenarios in different courses may be beneficial. Finally, another promising area for research might be to explore the effect of GBL on a various subjects/courses by using different sample groups and sampling techniques.

CONCLUSION

In the present study, educational games like cross word puzzles, playing card viva-voce, picture puzzles, adding suffixes, prefixes, filling the blanks, role play, group discussions, making words and quiz were used and proved that they are successful in creating interest towards learning of pathology.

Our data suggests that exposing the students to 'Educational Games' during tutorial sessions would improve their understanding of the facts and figures. The researcher sincerely hopes that this piece of work would prove helpful to all those concerned with teaching of pathology and other related branches of medicine.

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