

EFFECT OF GAMIFIED LEARNING ON KNOWLEDGE AND ITS ACCEPTANCE AMONG UNDERGRADUATE MEDICAL STUDENTS: A QUASI-EXPERIMENTAL STUDY

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ABSTRACT

Introduction: The integration of information and communication technology into the educational process enables learners to access a wide range of learning resources. Teachers face challenges in the classroom to create motivation and active participation in learning. Gamified learning can help students become more focused and lead to a deeper level of understanding. Although gamification and gamified learning are relatively new approaches in e-learning that have gained prominence with the development of new technologies, very few studies have highlighted their effectiveness in India. Hence, this study is chosen.

Aim and objectives: This study aims to assess the effects of gamifying Physiology classes on knowledge acquisition, satisfaction, and feedback regarding the use of gamified apps among undergraduate medical students.

Methodology: This Quasi-experimental study was conducted among first-year medical students aged ≥ 18 years. 248 students were divided into 4 groups with 62/63 students in each group. Randomly, two groups were selected as the study group. A validated pretest questionnaire was used to assess their knowledge on the chapters Blood and Immunity. Gamification tools like Socrative, crossword puzzles, Slido, and Google Forms were used while teaching. Post-test marks and feedback about the session and response to the gamification acceptance questionnaire were collected. From the two control groups, pretest marks, post-test marks, and feedback were collected following a routine class without using gamification apps.

Results: Continuous variables were expressed as mean $\pm$ SD. Categorical variables were expressed as percentages/proportions. Paired and unpaired t-tests were used for comparison within and between groups, respectively. There is a significant increase in knowledge gain in both groups, while the same is true with greater significance. The level of satisfaction was considerably high, and gamification was strongly appreciated in the study group. It was reported that 60% of the volunteers in the study group had prior exposure to gamification and the thematic analysis showed that students were interested in gamification and needed more gamified sessions. Slido was reported to be the most preferred game tool.

Conclusion: Gamifying medical education is observed to enhance students' depth of understanding as it provides an interactive learning environment with an increased level of satisfaction. It also enables the teacher to provide a student-centric learning environment. It is also observed that prior exposure to gamified learning sessions improves students' participation as it enables them to have better learning outcomes.

KEYWORDS: Acceptance, Gamification, Knowledge, Quasi-experimental

INTRODUCTION

In this digital era, powerful online platforms and AI tools have had a tremendous impact on economic, social, cultural, and on all dimensions of modern life. Integration of information and communication technology with the educational process facilitates learners in accessing a wide range of learning resources. Important challenges for teachers in the classroom are to create motivation and to engage students in active learning.¹ The traditional methods, like didactic lectures, may not help the students to maintain their attention span for more than 18 minutes due to their monotony, especially when teaching important topics to students.² Reduced student attention and engagement are often encountered in traditional didactic lectures. First-year medical students who are in the phase of transition from paedagogical to andragogical learning process face great difficulty in coping with the academic load of the medical curriculum, which is found as burdensome due to the lacunae in the teaching-learning methodologies practiced, which are different from those of learning in school days. Teaching and learning methods continue to change, and new methods are evolving. The rise in digital tools and the incorporation of artificial intelligence into teaching-learning programs make it feasible to implement engaging classroom activities.¹ Gamification is a new technique where game elements are used in non-gaming environments that enable students to actively participate in learning different medical terms and concepts. Gamified learning can help students become more focused and acquire a deeper level of understanding as these learning programs are motivating, interactive, and enhance information retention among the learners.

Gamification enhances students' confidence by helping them to easily retain the learned information and to participate in group activities.³ It is increasingly utilized in educational settings due to its potential to make learning enjoyable, memorable, and more effective. It offers new and exciting approaches that are yet to be fully explored and utilized in medical education.⁴ Research has shown that gamified educational design has a positive impact on improving students' knowledge, performance, and attitude. It has revealed the great potential in improving the teaching and learning processes.⁵ Although gamification and gamified learning are relatively new approaches in e-learning that have increased with the development of new technologies, very few studies have highlighted the effectiveness of this approach in India.^{6,7} Hence, this study was chosen to compare the knowledge level among first-year medical students before and after gamified sessions, to compare the knowledge level between the study and control group students, and to assess students satisfaction using the Game Acceptance Questionnaire among the study group and gather feedback about the session in both groups.

METHODOLOGY

This Quasi-experimental study was conducted among 250 first-year medical students (60% were female students and 40% were male students) of batch 2025- 2026 in the Department of Physiology at Sri Venkateshwara Medical College Hospital and Research Centre, Ariyur, Puducherry after getting scientific and ethical committee clearance. A convenience sampling method was used. The sample size was calculated based on the annual student admissions. 250 students admitted to the MBBS course were divided into four batches of about 62-63 students in each batch.

Each batch used to attend tutorials in the Physiology department once a month. Two of these four batches were randomly selected for gamification (study group), and the other 2 batches served as a control. Thus, each group (study & control) consisted of 124 students, all of whom were matched with age and year of admission. Given that data should not be distributed between the control and intervention groups, random selection was not feasible. Students aged more than 18 yrs and those who provided informed consent were included. Two students were absent during the session, and hence no one was excluded. The control group completed the routine training during the tutorial session. The study group underwent routine training combined with gamification of the session under the supervision of a faculty of the cadre of assistant professors and above.⁸

Intervention

Gamification activities using various digital tools were integrated at the end of tutorial sessions on specific physiology topics on Blood & Immunity.

Gamification Tools Used²

Socrative was used to frame 5 MCQ quizzes on "Erythropoiesis and Hemopoiesis."

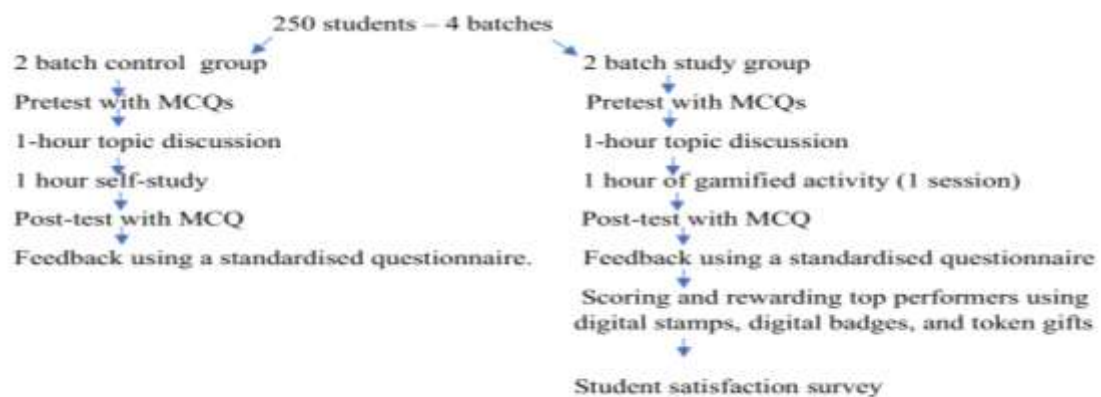
With Slido, a word cloud was utilized to emphasize the key points in Immunity

The crossword puzzle was framed on the key aspects of "Hemostasis and blood grouping"

Google Forms were used to frame image-based quizzes to differentiate the types of "Anemia"

Student satisfaction was assessed in the study group using the Game Acceptance Questionnaire.¹ The response is scored based on a Likert scale where 1 indicates strongly disagree and 5 indicates strongly agree. The validity and reliability of the questionnaire were checked before using it in the study. The general information on previous experience with gamification was obtained from the students. Feedback on the session was obtained using a standardised questionnaire from both groups, which is again scored based on a Likert scale where 1 indicates strongly disagree and 5 indicates strongly agree.²

Flowchart showing the Methodology in detail



Statistical Analysis

All the data were entered in an Excel sheet, and analysis was done using SPSS 23.0. Categorical variables were expressed as frequency/percentage. Continuous variables were expressed as mean±SD. Pre and post-test MCQ for 10 marks were compared using a paired t-test.

Post-test marks in both groups were compared using an unpaired t-test. P value < 0.05 was considered statistically significant. Thematic analysis was done to analyze the feedback/perception on the session (open-ended question).

RESULTS

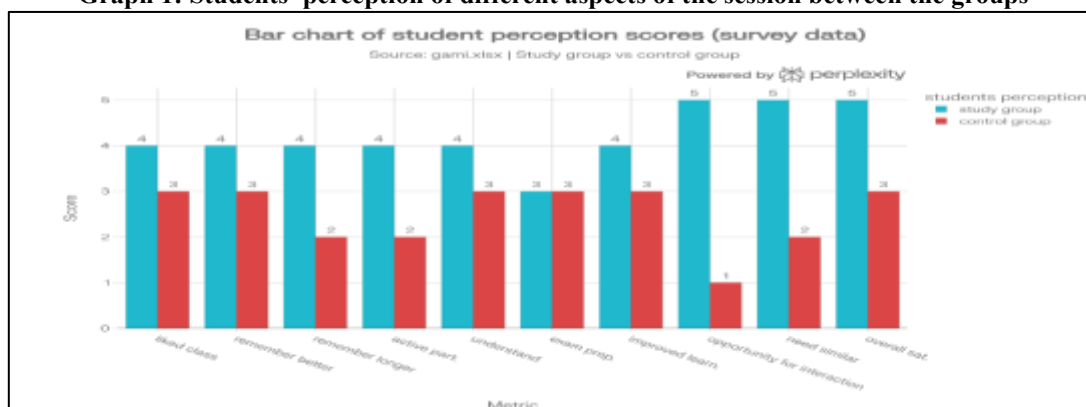
Table:1 Knowledge level of students between the study and control group

	Pre test (marks)	Post test (marks)	P value	% of improvement
Study group	5.77±1.64	8.08 ± 1.092	0.0001*	40 %
Control group	5.23±2.03	6.73±1.37	0.001*	28.68%
P value	0.021*	<0.0001*		

* P value < 0.05- statistically significant

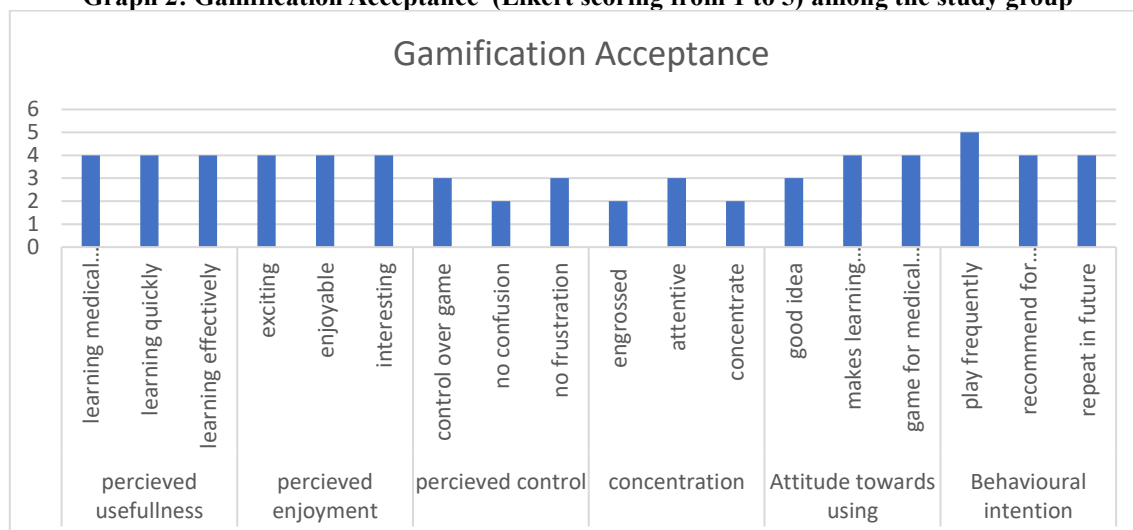
Table: 1 shows that paired student t test in study group is highly significant compared to control group. Also unpaired t test between the study group and control group stronger significance in the post test compared to the pretest. Study group showed 40% improvement in the mark compared to the control group showing only 28.68% improvement.

Graph 1: Students' perception of different aspects of the session between the groups



Graph: 1 shows that the study group strongly agrees that gamification provides an opportunity for interaction, needs similar sessions in the future, and overall they are satisfied. Whereas the control group strongly disagrees that tutorials provide an opportunity for interaction. In all other aspects, the study group agrees that gamification enabled them to remember better & longer, enhances active participation, and improves their learning. They were neutral about the role of gamification in motivation towards exam preparation. In contrast, the control group disagrees that they actively participated in the tutorial session and remember for a longer time.

Graph 2: Gamification Acceptance (Likert scoring from 1 to 5) among the study group



Graph: 2 shows that, except for perceived control and concentration, the study group has agreed on the usefulness, perceived enjoyment, attitude towards usage of the tools, and their behavioural intention towards gamification. Among the study group, 60% of the students were already exposed to gamification tools. 63% of the students preferred Slido, followed by the crossword puzzle by 42% and Socrative by 28%. Thematic analysis showed that students need more sessions like this and to be followed in other subjects too. Since it was a tutorial session, all the students were present on all four days

DISCUSSION

In the present study, it is observed that the tutorial session had significantly improved the knowledge level of the control group (28.68% improvement from pretest marks; $P=0.001$), and the study group that had tutorials along with gamification had a significant 40% improvement in the post-test score, reflecting an enhanced knowledge

level which is more significant ($P=0.0001$), as shown in Table 1. Similarly, Zahra Karimian et al. have reported that gamification of the teaching session effectively enhanced knowledge gain, skills, and student satisfaction.⁸ As shown in graph 2, Archana Bhat et al also identified that gamification helped students to understand and remember the content more easily, and students felt that the session was more interactive and facilitated the process of learning. The study group was interested in having more sessions on gamification, and their overall satisfaction was good.² In contrast, the control group strongly disagreed that tutorials provided an opportunity for interaction, and they strongly disagreed that they actively participated in the tutorial session and could remember the contents for a longer time.

The study group in this present study was neutral about the role of gamification in motivation towards exam preparation. In contrast, Manzano-León A et al, reported that gamification enhanced individuals' intrinsic motivation to achieve goals and overcome challenges.⁹

As depicted in graph 3, the study group was observed to have a strong agreement for -the usefulness, perceived enjoyment, positive attitude towards the usage of the tools, and their positive behavioural intention towards gamification. Similarly, Leili Mosalanejad et al, have mentioned that gamified learning has become an effective method for student engagement. It enhances the sense of enjoyment in learning among students.¹ Due to the immediate feedback and ranking, gamification can also be used as a formative assessment tool.¹⁰

Sixty percent of the participants in the study group had no previous training sessions on gamification and the majority of these students felt that they had no control over the gamification tools used.¹¹ The technical glitches that existed during the start of the gamified sessions were overcome within 10 minutes. This could be the reason for students' perception of reduced control and concentration towards gamified tools. Similarly, Ebadi S et al also have reported that technical delays and the high pace of the game are among the most frequently reported issues in digital learning, which can demotivate the learner, resulting in poor performance.¹²

CONCLUSION

Thus, it could be inferred from this study that gamification is an effective and efficient tool to enhance knowledge. It improves understanding, enhances motivation towards learning, and increases memory. Though the students' acceptance of gamification was satisfactory, they perceived less control over the gamification tools. With the provision of training sessions in priming students in handling these tools, the students could benefit better from these special learning sessions

Limitations

Feedback and perception on gamification among other stakeholders were not collected. Challenges faced by the teachers and students while using these types of tools were not collected. The immediate post-test MCQ was only compared. The academic score based on the internal assessment of both groups has not compared the effect of these sessions on long-term knowledge retention.

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