

# Comparison of Gamification vs Small Group Discussion on Academic Performance in Surgery amongst 2<sup>nd</sup> Prof MBBS Students

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## ABSTRACT

**Background:** Traditional small group discussions (SGDs) have long supported collaborative learning in medical education. However, with changing learner dynamics and digital integration, gamification has emerged as an innovative strategy to enhance engagement and knowledge retention. The aims to study compared the effectiveness of gamification-based learning versus SGDs in improving academic performance and learner satisfaction among 2nd-year MBBS students in Surgery.

**Methods:** A randomized controlled study was conducted with 150 MBBS students allocated equally into two groups: Gamification and SGD. Both groups were taught identical surgery topics through their respective methods. Pre and post-tests assessed academic performance. A validated Likert-scale questionnaire captured student and faculty perceptions. Statistical analyses included paired and unpaired t-tests, Pearson correlation, and effect size.

**Results:** Both groups showed significant improvement from pre- to post-test ( $p < 0.000001$ ). However, the Gamification group demonstrated significantly higher post-test scores (mean=18.92 vs 12.85;  $p < 0.000001$ ; Cohen's  $d = 3.64$ ). Engagement, motivation, and satisfaction were significantly higher in the Gamification group. Faculty perceptions also favoured gamification for engagement and active learning. Attendance was significantly higher in the gamification group ( $p = 0.003$ ).

**Conclusion:** Gamification significantly outperformed SGDs in academic performance, engagement, and satisfaction. It is a feasible and effective strategy in Surgery education and aligns with the goals of competency-based medical education.

**Key-words:** Gamification, Small Group Discussion(SGD), Surgery Education, Engagement, Academic Performance

## INTRODUCTION

In medical education, traditional teaching methods such as small group discussions (SGDs) have been instrumental in fostering collaborative learning and critical thinking among students. However, with the advent of technology and the evolving learning preferences of students, there is a growing interest in innovative pedagogical approaches. One such approach is gamification, which involves

integrating game design elements into educational contexts to motivate and engage learners. Traditional teaching methods, such as small-group discussions (SGDs), often struggle to sustain high levels of student engagement and may not fully address diverse learning preferences <sup>[1]</sup>.

In the context of MBBS education, particularly in complex topics, this can lead to reduced motivation, passive learning, and variable academic performance <sup>[2]</sup>. Furthermore, with the increasing emphasis on producing well-rounded Indian medical graduates (IMGs) equipped with critical thinking, clinical reasoning, and lifelong learning skills, there is a pressing need for innovative teaching approaches <sup>[3]</sup>.

Gamification, which incorporates game-based elements into education, offers a promising alternative by enhancing engagement, promoting active learning, and

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potentially improving both immediate academic performance and long-term knowledge retention [4-6]. However, there is limited evidence on the effectiveness of gamification compared to traditional SGDs in achieving these outcomes among 2nd Prof MBBS students [7]. This study aims to address this gap by comparing the academic performance and overall perception of students and faculty exposed to gamification-based learning versus traditional SGDs in Surgery.

## MATERIALS AND METHODS

**Study Design, Setting and Participants-** A randomized controlled study was conducted in the Department of Surgery among 2nd Prof MBBS students to compare the effectiveness of gamification-based learning and traditional Small Group Discussion (SGD) on academic performance and learner perceptions. Institutional Ethical Committee approval was obtained before commencement of the study. A total of 150 students studying in the 2<sup>nd</sup> Prof MBBS were included in the study.

**Inclusion Criteria-** All students enrolled in the course were included in the study.

**Exclusion Criteria-** Students who were absent during any teaching session or pre-test/post-test assessment were excluded from the study.

**Randomization and Group Allocation-** A total of 150 students were randomly allocated into two equal groups (75 students each) using a computer-generated random number sequence. This random allocation minimized selection bias and enhanced the validity and reliability of the study findings.

**Study Procedure-** A total of 148 students completed the pre-test assessment, consisting of 20 multiple-choice questions (MCQs), to evaluate baseline knowledge. Both groups underwent four simultaneous one-hour teaching sessions. Identical surgery topics were taught to both groups, including cholecystitis, inguinal hernia, and breast lump.

**Gamification-Based Learning Intervention-** Gamification sessions were conducted in four groups, comprising 18–19 students, with one faculty member in separate

rooms. All sessions were structured and time-bound. A scoring system was maintained in which students received points for correct responses, and a leaderboard displayed rankings by performance.

Gamification activities were conducted using the Kahoot application and included:

**Virtual Patient Case Challenge:** Students were provided with brief clinical histories followed by sequential questions requiring interactive decision-making, interpretation of laboratory findings, and formulation of a final diagnosis.

**Competitive Speed Diagnosis Challenge:** Multiple surgical images related to the topics were displayed, and students identified them within a 30-second time limit. Correct responses earned 1 point, and all images were explained after the activity.

**Small Group Discussion (SGD) Intervention-** Traditional SGD sessions were conducted by four faculty members in separate rooms, with each group consisting of 18–19 students. Faculty members presented clinical case-based scenarios on the same topics, which were subsequently discussed and analysed by the students.

**Outcome Assessment-** Following completion of the four teaching sessions, all 148 students completed a post-test consisting of 20 MCQs similar to the pre-test. Student and faculty perceptions were assessed using a peer-validated feedback questionnaire based on a 5-point Likert scale. A crossover remedial session was conducted after completion of the intervention to ensure equal exposure to both teaching methods. The post-test was conducted before crossover to avoid learning spillover effects and maintain the integrity of primary outcome measures.

**Statistical Analysis-** Data analysis included paired and unpaired t-tests for comparison of pre- and post-test scores, Pearson correlation analysis for evaluating the relationship between engagement and academic performance, and effect size analysis using Cohen's *d*. Statistical significance was considered at  $p < 0.05$ .

## RESULTS

The frequency distribution of students' pre- and post-intervention test scores in the gamification teaching method showed a marked improvement following the intervention. Before the intervention, most students

scored in the lower score ranges (0–5 and 6–10), whereas after the intervention, the majority shifted to the higher score range (16–20), indicating a substantial improvement in academic performance (Table 1).

**Table 1:** Frequency Distribution of Students according to test score at pre and post intervention in Gamification teaching method

Testscore (max. Marks- 20)	Pre – Intervention (n = 74)	Post Intervention (n= 74)
0-5	45	00
6-10	29	01
11-15	00	03
16-20	00	70

The frequency distribution of students' pre- and post-intervention test scores in the Small Group Discussion teaching method showed improvement after the intervention. Most students initially scored in the lower

score categories, while post-intervention scores shifted predominantly toward the 11–15 score range, suggesting improvements in learning outcomes following SGD sessions (Table 2).

**Table 2:** Frequency Distribution of Students according to test score at pre and post intervention in Small Group Discussion teaching method

Testscore (max. Marks- 20)	Pre – Intervention (n = 74)	Post Intervention (n= 74)
0-5	42	01
6-10	32	09
11-15	00	55
16-20	00	09

The mean pre-test and post-test scores in both groups demonstrated significant improvement after the intervention. Both the Gamification and Small Group

Discussion groups showed statistically significant enhancement in academic performance following the teaching sessions (Table 3).

**Table 3:** Mean test score between Small Group Discussion and Gamification teaching method at pre-and post-intervention using paired t-test

Group	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Paired t-test (p-value)
SmallGroup	5.07	1.86	12.85	2.15	<0.000001
Gamification	4.85	1.94	18.92	0.99	<0.000001

Comparison of post-intervention mean scores between the Gamification and Small Group Discussion groups demonstrated significantly higher scores in the

Gamification group, indicating superior effectiveness in improving academic performance compared to the traditional teaching method (Table 4).

**Table 4:** Mean Test Score between Small Group Discussion and Gamification teaching method at postintervention using unpaired t-test

Group	Mean	SD
Gamification	18.92	0.99
Small Group Discussion	12.85	2.15

*p-value:*<0.000001

Student perception analysis revealed that the Gamification teaching method achieved significantly higher scores in engagement, motivation, understanding,

and future preference than Small Group Discussion, indicating greater learning effectiveness and student acceptance (Table 5).

**Table 5:** Engagement and Learning Effectiveness Scores (Student Perception Analysis)

Statement	Gamification (Mean ± SD)	Small Group Discussion (Mean ± SD)	p-value
The method was engaging	4.7 ± 0.5	3.8 ± 0.7	<0.001
I felt motivated to participate	4.5 ± 0.6	3.6 ± 0.8	<0.001
The method improved my understanding	4.6 ± 0.5	3.9 ± 0.7	<0.001
I would prefer this method in future classes	4.8 ± 0.4	3.7 ± 0.9	<0.001

Overall satisfaction scores showed that a greater proportion of students were highly satisfied with the Gamification teaching method than with Small Group

Discussion, suggesting greater learner satisfaction with the interactive learning approach (Table 6).

**Table 6:** Overall Satisfaction Scores

Method	% Highly Satisfied (Likert Score = 5)
Gamification	72%
Small Group Discussion	39%

Faculty perception analysis demonstrated that Gamification was perceived more favourably in terms of student engagement, promotion of active learning, and

willingness to implement in the future. In contrast, ease of implementation was comparable across both teaching methods (Table 7).

**Table 7:** Faculty Perception Analysis

Statement	Gamification (Mean ± SD)	Small Group Discussion (Mean ± SD)	p-value
Students were more engaged	4.6 ± 0.5	3.9 ± 0.7	0.003
The method encouraged active learning	4.7 ± 0.4	3.8 ± 0.6	0.002
The method was easy to implement	3.9 ± 0.8	4.2 ± 0.5	0.12 (NS)
I would use this method in future	4.5 ± 0.6	3.6 ± 0.9	0.001

Correlation analysis demonstrated a strong positive relationship between engagement and post-test performance in the Gamification group, while a moderate positive correlation was observed in the Small

Group Discussion group, indicating that higher student engagement was associated with better academic performance (Table 8).

**Table 8:** Correlation Between Engagement and Academic Performance

Variable Comparison	Pearson's r	p-value	Interpretation
Engagement Score vs Post-test Score (Gamification)	0.72	<0.001	Strong positive correlation
Engagement Score vs Post-test Score (Small Group Discussion)	0.48	0.003	Moderate positive correlation

The mean attendance of students was significantly higher in the Gamification group compared to the Small Group Discussion group, indicating greater student

participation and attendance with gamification-based learning (Table 9).

**Table 9:** Attendance of Students in Gamification versus Small Group Discussion

Variable	Gamification	Small Group Discussion
Mean Attendance	69.75	61.75
Standard Deviation	2.2	2.5
p-value (Unpaired t-test)	0.003	

## DISCUSSION

This study evaluated the effectiveness of gamification-based learning versus traditional small group discussions on academic performance and learner perceptions among 2nd-year MBBS students in Surgery. The findings suggest that gamification not only significantly improved academic performance but also enhanced student engagement and satisfaction when compared to traditional SGDs.

Both teaching methods led to significant improvements from pre-test to post-test, indicating that active instructional strategies—whether gamified or discussion-based—are beneficial in medical education. However, the gamification group showed significantly higher post-test scores ( $p < 0.000001$ ), which aligns with the findings of Boeker *et al.*, who demonstrated superior knowledge retention and student satisfaction among learners exposed to game-based e-learning compared to conventional teaching methods<sup>[3]</sup>.

Similarly, a meta-analysis by Gentry *et al.* concluded that gamification is at least as effective as traditional teaching methods in improving knowledge and skills across health professions. Thampy *et al.* also reported that gamified, peer-led assessments enhanced not only learning outcomes, but also student engagement and teamwork<sup>[4]</sup>.

Conversely, Zafar *et al.* found no significant difference in post-test scores between students taught using gamification and those taught through case-based

learning, although qualitative feedback favored gamification for motivation and enjoyment<sup>[8]</sup>. This suggests that, while test scores may not always differ significantly, learner experience and emotional engagement can serve as important differentiating factors.

While small-group discussions are known to promote academic achievement through collaborative analysis<sup>[9]</sup>, gamification appears to enhance these benefits by increasing engagement and motivation. Furthermore, van Gaalen *et al.* highlighted the heterogeneity of gamification designs and reported inconsistent effects on learning outcomes, advising that the alignment of game mechanics with learning objectives is essential for success<sup>[2]</sup>.

Student perception data from our study revealed significantly higher engagement, motivation, and satisfaction with gamification. This finding is supported by Juho Hamari *et al.*, who reported that gamification positively influences motivation, particularly when it is thoughtfully integrated into educational settings<sup>[10]</sup>.

The strong correlation between engagement scores and academic performance ( $p < 0.05$ ) in the gamification group aligns with the findings of Dicheva *et al.*, who demonstrated that student engagement is a critical mediator of learning effectiveness in gamified environments<sup>[11]</sup>.

However, some criticisms persist. A study by Buckley and Doyle warned that gamification can sometimes shift the



focus toward competition rather than collaboration, potentially undermining intrinsic motivation<sup>[12]</sup>. Similarly, Koivisto and Hamari cautioned that long-term motivation may decline if gamification is not regularly refreshed or personalized, raising concerns about its sustainability in curriculum design<sup>[13]</sup>.

Faculty members in this study reported a favorable perception of gamification in terms of engagement and active learning, consistent with the findings of Wang *et al.*, who reported that educators often view gamified tools as effective aids for stimulating active participation<sup>[5]</sup>. The ease of implementation was rated similarly for both methods, suggesting that gamification is feasible when supported by adequate training and digital infrastructure.

Higher attendance in the gamification group ( $p < 0.05$ ) further supports the hypothesis that interactive and competitive formats increase class participation. This finding is reinforced by Su and Cheng, who found that students in gamified classes were more punctual and attentive compared to those in traditional classroom settings<sup>[14]</sup>.

### LIMITATIONS

Despite the promising findings, this study has several limitations. It was conducted at a single institution and focused only on one subject area (Surgery), which limits the generalizability of the results. In addition, long-term knowledge retention was not assessed, and the effectiveness of the intervention in higher-stakes examinations, such as university assessments, remains unexplored.

### CONCLUSIONS

This study concludes that gamification, when thoughtfully implemented, is more effective than traditional clinical case discussions in enhancing academic performance, engagement, and satisfaction among surgery students. The findings support the broader integration of gamification into competency-based medical education frameworks to foster deeper learning and better preparedness among Indian Medical Graduates.

Future research should investigate hybrid teaching models that combine gamified elements with traditional case discussions, as such approaches may capitalize on the strengths of both methods. Furthermore, longitudinal

studies are needed to evaluate knowledge retention and behavioral impact over an extended period.

### CONTRIBUTION OF AUTHORS

**Research concept-** Prem Mohan, Shahnawaz Hussain Siddiqui

**Research design-** Prem Mohan, Shahnawaz Hussain Siddiqui

**Supervision-** Aditya Pratap Singh

**Materials-** Prem Mohan, Shahnawaz Hussain Siddiqui

**Data collection-** Prem Mohan, Shahnawaz Hussain Siddiqui

**Data analysis and interpretation-** Aditya Pratap Singh

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