

Effectiveness of A Gamified Learning Approach Compared To Google Form–Based Assessment In Medical Education: Randomised Control Study

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Abstract- Background: Gamification is increasingly used in medical education to improve learner engagement, motivation, and knowledge retention. There is a worldwide shortage of health workers, and this issue requires innovative education solutions. Serious gaming and gamification education have the potential to provide a quality, cost-effective, novel approach that is flexible, portable, and enjoyable and allow interaction with tutors and peers.[1] However, evidence comparing gamified strategies with conventional Google Form–based assessments is limited.

Objectives: To evaluate the effectiveness of a gamified learning approach compared to standard Google Form quizzes among undergraduate medical students.

Methods: A Randomised control trial was conducted among second-year MBBS students using computerised randomisation. Participants were divided into two groups: (1) Google Form Group, using traditional multiple-choice assessments and (2) Gamified Learning Group, using an interactive platform (e.g., Kahoot/Quizizz). Pre- and post-tests were administered. Outcomes included improvement in test scores, student engagement, satisfaction, and perceived usefulness assessed via Likert-scale questionnaires. Data were analysed using independent sample t-test.

Results: The parameters measured have demonstrated effectiveness; encouraged review (3.40), fit with lectures (3.65), increased understanding (3.59), lower recall (3.19), moderate user engagement (3.15), interactivity (3.18) and interest (3.14). Usability has been assessed as satisfactory: user friendly (3.60), good difficulty (3.48) and appropriate time (3.56). Group 2 significantly outperform group 1 in every aspect, especially in the recall (4.13 and 2.25), engagement (4.13 and 2.18), interactivity (4.18 and 2.18) and interest (3.83 and 2.45) parameters. The usability parameters in Group 2 also significantly outperform Group 1: user friendly (3.95 and 3.25), difficulty (3.68 and 3.28) and time (3.75 and

3.38). The range for standard deviation (from 0.59 to 1.20) represents moderate variance and overall results indicate that Group 2 appears more successful.

Conclusion: Gamified learning is more effective than Google Form–based assessments in improving learning outcomes, engagement, and satisfaction in medical education. Incorporation of gamified tools is recommended for routine teaching-learning activities.

Keywords: Gamification, Medical Education, Google Forms, Interactive Learning, Assessment.

I. INTRODUCTION

There is an ongoing, comprehensive standard shift in the realm of medical education where digital tools and strategies for learning are being introduced, particularly to improve the quality of teaching and increase motivation and engagement among learners. This trend toward technology-mediated pedagogy is a necessary intervention to overcome challenges presented by traditional lecture-based teaching that promotes passive assimilation of information and a loss of interest on the part of students, which is particularly pronounced in resource-poor contexts like the Indian medical colleges. Non-interactive learning management systems like Google Forms are widely used in various educational institutions for quick quizzes and formative assessments due to their simplicity and flexibility. Teachers can use Google Forms to administer questions and collect student responses almost instantaneously, displaying a live tally of the performance which is advantageous in areas with less student population as is seen in majority of Indian institutes.

However, tools like Google Forms and other similarly non-interactive methods often fail to induce a sustainable level of active learning and student involvement. Students are tested on recall abilities for questions asked via

Google Forms, thus it results in superficial retention and sustained for less time.

Therefore, gamification- an approach that involves the strategic implementation of game design elements such as points, badges, leaderboards, levels, awards, competition, and immediate feedback to motivate and engage learners in non-game contexts-has been suggested as a potential solution. By turning blank tests into interactive and entertaining activities, the game-based platforms like Kahoot, Quizizz, and Mentimeter employ a similar set of motivating strategies as seen in video games by tapping into students' desire for competition, accomplishment and interaction through points and leaderboards to generate intrinsic motivation. Studies have established the positive effects of gamification on engagement and student performance in general educational contexts, while those related to medical education have also found improvements in student attention spans, knowledge retention (upto 20-30%), and motivation^[3]. For example, competitive, live-action quiz sessions like those conducted via Kahoot resulted in greater participation and significantly higher recall rates than those obtained through traditional teaching methodologies due to the stimulating elements like a time constraint and celebration animations^[3].

Nevertheless, few studies are available comparing head-to-head the efficacy of these innovative learning methodologies against the more rudimentary ones in Indian medical education scenario. Given the fact that there are over 700 medical colleges producing more than 100,000 graduates per year, and due to issues like overcrowded classrooms, learner heterogeneity, and the lack of readily available technologically advanced learning devices, research is essential to guide teaching methods. Moreover medical students are having relatively less attention span, vague google form approach alone cannot be an effective method. Local studies from India have indicated that gamification can be a highly successful teaching strategy, however comparative head-to-head studies against traditional tools like Google Forms are scarce with factors like local cultures' perceptions of competition, access to a stable internet connection, and curricula that may need to be accommodated also influencing pedagogical interventions^[1].

The present randomized controlled study attempts to fill this gap by comparing the effectiveness of a gamified learning intervention (via Quizizz) against conventional testing by Google Forms in enhancing knowledge acquisition, retention, and engagement among medical students. Employing an experimental design with pre- and post-intervention testing of the learned knowledge, measures of engagement (like session duration, and completion rates), and standard instruments (like the User Engagement Scale), this

study will serve as an evidence-based guide for educators attempting to optimize digital learning interventions in similar resource-limited scenarios^[5].

OBJECTIVES

To evaluate the effectiveness of a gamified learning approach compared to standard Google Form quizzes among undergraduate medical students.

MATERIALS AND METHOD

- Study design: Randomized Control Trial
- Study area and Population: Government Medical College, Omandurar government estate and Phase II MBBS students
- Sample size: The sample size required for the study is calculated using the parameters (mean and standard deviation) from the previous literature, with the prevalence 50% which showed the difference in the mean score at a 95% confidence interval using the formula.

$$n = \frac{Z^2 \times p(1-P)}{d^2}$$

N= 40 in each arm

Total estimated sample size = 40+40=80

- Period of study: 3 Months
- Study tool: predesigned closed structured questionnaire using likert scale

INCLUSION CRITERIA:

- o Candidates who gave consent to participate.
- o Candidates who have access to device.
- o Candidates who are exposed to topic.

EXCLUSION CRITERIA:

- o Candidates who are absent on that day/ not gave consent.
- o Candidates who have technical issues in their device.

METHODOLOGY

This is a Randomized control type of study designed to study the perception of students on gamification in medical education. This study was done after a pathology lecture among phase 2 medical students of sample size 80. The topic

chosen for the study was “NEOPLASIA.” Students were divided into two groups, one exposed to a Google Form and another to a gamified quiz platform (QuizWizzer) for their post-lecture test.

Students were split into two groups based on computer generated randomization list.

From the total of 80, 40 students were made to attempt the Google Forms test (**Group 1**) as the post-lecture test. Google Forms were created on the topic, with 10 multiple-choice questions of different difficulty levels for equal evaluation. Students were asked to answer the test in 15 minutes after the pathology lecture. The top scorers were applauded and appreciated in the class.

Another set of 40 students was made to attempt the quiz prepared in the application—QuizWhizzer (**Group 2**). This application allows the students to join, answer the question, and race amongst each other. Each student was assigned a character. As each question is answered, the character of the students will move 2 steps forward in the racing map, and for every wrong answer, the character will move one step backward. As they move forward, they get power-ups like freezing other characters, bonus moves, etc. Finally, winners will be decided based on who crosses the finishing line first. Top scorers were applauded and appreciated in the class. Following the test, feedback forms were provided to both groups through Google Forms.

RESULT

The analysis included a total of 80 participants (40 in each intervention group). The total mean scores indicated [Table1]that the interventions encouraged review (mean = 3.40), were aligned with lectures (mean = 3.65), and improved understanding of the topic (mean = 3.59). Improvements in recalling showed a comparatively lower mean score (3.19). User engagement (mean = 3.15) and interactivity (mean = 3.18) were rated moderately, while increased interest scored a mean of 3.14.

Regarding usability aspects, user friendliness (mean = 3.60), suitability of difficulty (mean = 3.48), and time management (mean = 3.56) were positively rated. When comparing the two groups, Group 2 consistently demonstrated higher mean scores across all domains compared to Group 1. For instance, Group 2 showed higher scores in improved recalling (4.13 vs. 2.25), user engagement (4.13 vs. 2.18), interactivity (4.18 vs. 2.18), and increased interest (3.83 vs. 2.45). Similarly, usability parameters such as user friendliness

(3.95 vs. 3.25), suitable difficulty (3.68 vs. 3.28), and time management (3.75 vs. 3.38) were also rated higher in Group 2.

The standard deviations across domains ranged from 0.59 to 1.20, indicating moderate variability in responses. Overall, the findings suggest that the second group was more effective in enhancing learning outcomes, engagement, and usability compared to the first group.

Table 1 :Standard deviation, Mean value of two intervention groups

Interventions	Encouraged to review	Aligned with lectures	Understanding of topic	Improved recalling
Group 1 Mean	3.050	3.450	3.275	2.250
N	40	40	40	40
Std. Deviation	.9323	.7828	.8161	.6304
Maximum	SA	SA	SA	A
Minimum	SD	D	SD	SD
Group 2 Mean	3.750	3.850	3.900	4.125
N	40	40	40	40
Std. Deviation	.7425	.6222	.6718	.6071
Maximum	SA	SA	SA	SA
Minimum	D	D	N	N
Total Mean	3.400	3.650	3.587	3.187
N	80	80	80	80
Std. Deviation	.9085	.7309	.8065	1.1261
Maximum	SA	SA	SA	SA
Minimum	SD	D	SD	SD

Table 1.2

Interventions	User engagement	Interactive	Increased Interest	User friendly	Suitable difficulty
Group1 Mean	2.175	2.175	2.450	3.250	3.275
N	40	40	40	40	40
Std. Deviation	.5006	.5943	.6385	.7425	.7157
Maximum	A	A	A	SA	SA
Minimum	SD	SD	SD	SD	D
Group2 Mean	4.125	4.175	3.825	3.950	3.675
N	40	40	40	40	40
Std. Deviation	.6864	.7472	.5943	.8149	.7299
Maximum	SA	SA	SA	SA	SA
Minimum	N	N	N	D	D
Total Mean	3.150	3.175	3.137	3.600	3.475
N	80	80	80	80	80
Std. Deviation	1.1485	1.2094	.9243	.8509	.7459
Maximum	SA	SA	SA	SA	SA
Minimum	SD	SD	SD	SD	D

Table1.3

Interventions		Time management	
Group 1	Mean		3.375
	N		40
	Std. Deviation		.6279
	Maximum	SA	
	Minimum	D	
Group 2	Mean		3.750
	N		40
	Std. Deviation		.6699
	Maximum	SA	
	Minimum	N	
Total	Mean		3.562
	N		80
	Std. Deviation		.6721
	Maximum	SA	
	Minimum	D	

An independent samples t-test was conducted to compare the effectiveness of the two intervention group (Group 1&2) [Table 2]. There was a statistically significant difference between the two groups in all measured variables.

For learning-related outcomes, a significant difference was observed in understanding of the topic ($t = -3.74, p < 0.001$), encouragement to review ($t = -3.72, p < 0.001$), and alignment with lectures ($t = -2.53, p = 0.013$). Similarly, highly significant differences were found in user engagement ($t = -14.52, p < 0.001$), improved recalling ($t = -13.55, p < 0.001$), interactivity ($t = -13.25, p < 0.001$), and increased interest ($t = -9.97, p < 0.001$).

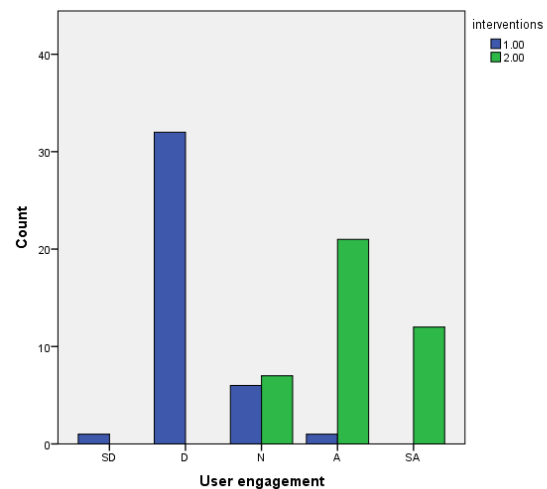
Regarding usability parameters, statistically significant differences were also noted in user friendliness ($t = -4.02, p < 0.001$) and suitability of difficulty ($t = -2.48, p = 0.015$).

Overall, all domains demonstrated statistically significant differences between the two groups ($p < 0.05$), with the magnitude and direction of mean differences indicating superior performance of the second group compared to the first.

Table 2: Independent Samples Test

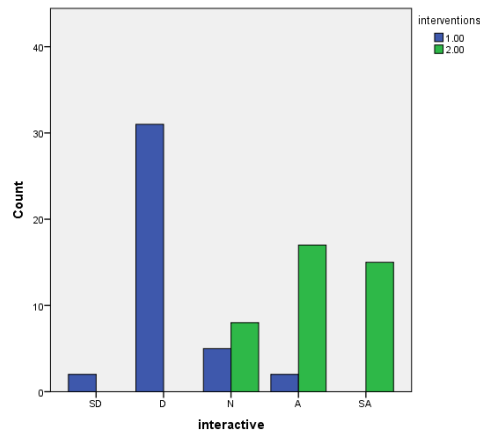
		t-test for Equality of Means		
		Sig. (2-tailed)	95% Confidence Interval of the Difference	
			Lower	Upper
Understanding of topic	Equal variances assumed	.000	-.9577	-.2923
	Equal variances not assumed	.000	-.9579	-.2921
Encouraged to review	Equal variances assumed	.000	-1.0752	-.3248
	Equal variances not assumed	.000	-1.0755	-.3245
Aligned with lectures	Equal variances assumed	.013	-.7148	-.0852
	Equal variances not assumed	.014	-.7150	-.0850
User engagement	Equal variances assumed	.000	-2.2174	-1.6826
	Equal variances not assumed	.000	-2.2178	-1.6822
Improved recalling	Equal variances assumed	.000	-2.1505	-1.5995
	Equal variances not assumed	.000	-2.1505	-1.5995
interactive	Equal variances assumed	.000	-2.3005	-1.6995
	Equal variances not assumed	.000	-2.3008	-1.6992
Increased interest	Equal variances assumed	.000	-1.6496	-1.1004
	Equal variances not assumed	.000	-1.6496	-1.1004
User friendly	Equal variances assumed	.000	-1.0470	-.3530
	Equal variances not assumed	.000	-1.0471	-.3529
Suitable difficulty	Equal variances assumed	.015	-.7218	-.0782
	Equal variances not assumed	.015	-.7218	-.0782
Time management	Equal variances assumed	.012	-.6640	-.0860
	Equal variances not assumed	.012	-.6640	-.0860

Figure 1: The given bar graph shows user engagement among the participants between the two groups



- 1-Group1
- 2-Group 2
- SD-Strongly disagree
- D-Disagree
- N-Neutral
- A-Agree
- SA-Strongly agree

Figure 2: The given bar graph shows the interaction of the participants towards the assessment



- 1-Group1
- 2-Group 2
- SD-Strongly disagree
- D-Disagree
- N-Neutral
- A-Agree
- SA-Strongly agree

DISCUSSION

The study has been conducted to evaluate the effectiveness of a gamified learning approach compared to standard Google Form quizzes among undergraduate medical students in Government Medical College, Omandurar Government Estate, Chennai.

The intervention group comprised of 80 participants with 40 per intervention condition. The intervention was evaluated in terms of encouraging review (mean = 3.40), lectures congruence (mean = 3.65), and improved comprehension of subject matter (mean = 3.59). The latter was achieved more moderately, than recall which was shown as relatively lower mean score (3.19). User parameters were reported as moderate (user engagement=3.15, interaction=3.18, and increased interest=3.14).

When comparing the groups, Group 2 achieved mean scores greater than Group 1 for all measured areas. In particular, Group 2 performed significantly better on enhanced recall (4.13 vs. 2.25), user interaction (4.13 vs. 2.18), interactivity (4.18 vs. 2.18), and enhanced interest (3.83 vs. 2.45). The usability variables, user friendly (3.95 vs. 3.25), appropriate difficulty (3.68 vs. 3.28) and adequate time allocation (3.75 vs. 3.38), were higher as well.

In this study, we are looking at how well gamified learning platforms perform compared to traditional tools like Google Forms for second-year medical students. As technology becomes a bigger part of medical education, it is important to explore new teaching methods that increase student participation and improve learning outcomes^[2]. This study aims to find out if gamified learning platforms truly impact learning and help students engage with the material. By comparing these platforms to conventional assessment tools, we hope to understand what works best for students and how we can use technology to improve their learning experience.

In this study, students exposed to the gamified learning approach showed better engagement and more positive feedback than those assessed through Google Forms. This result supports earlier studies suggesting that gamification boosts motivation and participation among learners. The features of gamified systems include competitive elements, higher cognitive engagement, and better information retention. Moreover, gamified learning seems to promote active learning. While Google Forms provides a systematic and effective way to assess, it lacks the interactive and motivational features^[3]. These differences may explain the higher scores on the Likert scale seen in the gamified group in our research. One important point is that platforms using game-like elements can provide students with instant feedback. This helps them quickly recognize their strengths and areas needing improvement. The findings of this study align with previous research showing that gamification tools enhance student satisfaction and learning outcomes in medical education. However, it's crucial to note that while gamification increases engagement, its direct effect on long-term knowledge retention and academic performance needs more investigation^[5]. When introducing gamified tools into the curriculum, careful consideration is necessary.

There are many factors to weigh, such as which platform to choose, how to train teachers, and ensuring everything fits with the overall teaching goals. If we can blend traditional teaching with gamified assessments, it might offer a great balance and genuinely support student learning. This

method can keep things interesting and enjoyable while still providing a solid education.

Despite its advantages, this study has limitations. It was conducted in a single institution with a relatively small sample size, which may affect the generalizability of the findings. Additionally, this study mostly evaluated student perception using Likert scale scores.

The short duration of the intervention also restricts conclusions about long-term learning outcomes. Future research should focus on multi-center studies with larger sample sizes and include objective measures of academic performance. Comparative studies between different gamified platforms may help to identify the most effective tools for medical education. Using games to learn can really excite and engage students. It often works better than traditional tools like Google Forms^[4]. If we adopt more engaging and innovative teaching methods in medical school, it could significantly enhance student learning and their overall experience.

Conclusion

The findings indicate that although both the Google Form based assessments and the gamified approach enhanced comprehension and aided in review among undergraduate medical students, the gamified intervention proved to be the more beneficial strategy in almost every aspect. Students in the gamified section of the intervention were not only more interactive and engaged but demonstrated a better ability to recall, and had an increased interest in, as well as the more positive regard to the ease, difficulty and time in the use of the tool. The results conform to similar existing data, which shows that learning aided by gamification leads to greater motivation and interaction than learning by passive recollection, as that found in the control group's approach to using the Google Forms assessments. Though both were well perceived by participants, the low recollection and moderate engagement found within the control group indicate that these non-interactive tools may have drawbacks. Across all parameters of the survey there was a consistently better rating for the gamified intervention, backed by significant results in most instances, and as a result the gamified learning tool should be implemented in an undergraduate medical curriculum.

DECLARATION

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Conflict of Interest :Nil

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