

Enhancing Engagement: The Transformative Power of Gamified Learning for Nursing and Medical Students

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Abstract: Gamification has gained traction in education, proven to boost student motivation and engagement. Its application in statistics courses has shown promising results, enhancing performance and attitudes towards the subject. With evolving learning styles, especially among Millennials, traditional teaching methods need reassessment to ensure effective engagement and understanding of statistical concepts, which are crucial for academic success. This study aims to assess the impact of gamified experiences introduced through Statopoly, a Monopoly-inspired game integrating statistics principles, on student engagement in a statistics course. Using the GAMEFULQUEST questionnaire, the study explores the effects of six key gamified experience factors on student engagement, considering cognitive and affective dimensions. Surveys were conducted with 111 students and engagement was assessed through quantitative methods. The findings reveal significant differences between Nursing and Medical students across four dimensions of the gamified learning experiences, as well as significant differences in the impact of gamification on student engagement. The result also shows a strong positive correlation between gamified learning experiences and student engagement. These outcomes underscore the promising role of gamification as a catalyst for innovation in statistics education.

Keywords: Gamification, Gamified Experiences, Student Engagement

1. Introduction

Gamification in teaching and learning has become a prominent trend in the past decade, revolutionizing educational methodologies across various levels and disciplines. Gamification, the practice of incorporating game elements into nongaming platforms, greatly enhances routine tasks by making them more engaging and rewarding (Tomaselli, Sanchez, & Brown, 2015). Gamified experiences are described as “positive emotional and involving qualities of using a gamified application” (Högberg, Hamari, & Wästlund, 2019). These experiences mainly occur when the user’s intrinsic motivations, such as the desire to learn, be entertained, or socialize are triggered (Yang, Asaad, & Dwivedi, 2017). Gamified education incorporates game elements such as scoring, competition and learning goals achievement to motivate and engage students (Swacha, 2021). Many studies have shown the positive effects of game-based learning, including the development of social, higher-order thinking and problem-solving skills (Tukiman, Foong, Khalid, Ahmad, & Mohamed, 2019; Felszeghy et al., 2019). Incorporating gamified elements in teaching and learning leverages human’s natural inclination toward

challenges, achievements and social interaction. This can lead to continuous engagement and a deeper understanding of the subject content.

Study engagement refers to “the positive and fulfilling experience associated with learning, including energy, focus and absorption in education” (Zhang, Feng, & Li, 2021). Student engagement is crucial for educational success, and gamification has proven effective in enhancing it. Implementing gamification in education can address the disengagement many students feel with traditional teaching methods as increased motivation and higher engagement levels are directly linked to the introduction of gamification techniques (Alsawaier, 2018). Today, the rapid increase in publicly available data makes the need for public understanding of statistics and data interpretation more crucial. However, many students perceive statistics as a complex subject and despite gamification being recognized as beneficial in education in enhancing student engagement, statistical literacy is rarely explored as a gamification context in the literature (Legaki & Hamari, 2019).

In IIUM, Foundation students following the Biological Module consists of the following programmes - Allied Health Science, Biological Science, Dentistry, Medicine, Pharmacy and Nursing. These students are required to take a Statistics subject that covers topics ranging from Introduction to Statistics to Hypothesis Testing. However, the SPM entry requirement to the Foundation level of these students vary. Students from the Dentistry, Medicine and Pharmacy programmes must have strong results in Mathematics and Additional Mathematics and in this study, they are grouped together as the Medical Sciences students. The Nursing programme students on the other hand, are not required to have a background in Additional Mathematics. This difference results in a gap in their understanding of the Statistics subject, with the Medical Sciences students rarely encountering difficulties, while Nursing students struggle to grasp the concepts.

In this research, the Statopoly game was developed to gamify the content of the first two chapters of the Statistics course. It consists of a STATOPOLY game board, monopoly money, a pair of dice, 4 tokens, houses, hotels, chance cards, community chest cards and Statistics question cards. The students played in pairs with a total of 8 players, 1 banker and 1 question manager for every game. The time taken to play the game was around 60 to 90 minutes. Before the game started, the question manager explained the instructions. Students then took turns rolling the dice to play. The game rule was such that the students were required to answer Statistics questions from Topic 1 (Introduction to Statistics) and 2 (Counting Rule and Probability) with various levels of difficulty when landing on specific lots on the STATOPOLY board. If they landed on an empty lot, they could buy the lot if they answered the question correctly. If they landed on a lot owned by another team, they earned a 50% discount of the rent if they answered correctly and had to pay the full rent if they answered wrongly. At the end of the game, the winning pair was determined by their accumulated wealth, including money and properties. This gamification approach was implemented to support students who struggle with the content thus lack engagement and understanding of the subject. It serves as a supporting teaching material that promotes fun learning. However, research on the impact of gamification on motivation and engagement remains limited in several aspects (Felszeghy et al., 2019). By focusing on these two groups of students, we aimed to contribute to the existing body of research that has demonstrated the effectiveness of gamification in enhancing engagement in this area.

In summary, this study addresses the central research question: “How do gamified experiences via Statopoly impact student engagement? Is there any significant difference in engagement between Nursing and Medical students, and what is the relationship between gamified learning experiences and engagement among these students?” Our research focuses on three main objectives:

- i. To evaluate the impact of gamified experience through Statopoly on student engagement.
- ii. To compare the engagement levels between Nursing and Medical Sciences students.
- iii. To investigate the correlation between gamified learning experiences and student engagement among the
- iv. Nursing and Medical Sciences students.

2. Methodology

Population & Sampling Technique

The population for this study was the students who took Statistics course in Semester 3, Session 2023/2024. By using the convenience sampling technique, 111 samples consisting of 57 Nursing students and 54 Medical Sciences (Medicine, Dentistry and Pharmacy) students were chosen to play Statopoly in Statistics class. The duration was from 6th May 2024 until 17th May 2024.

Data Collection

A set of GAMEFULQUEST questionnaire consisting of seven dimensions which are Accomplishment, Challenge, Competition, Immersion, Playfulness, Social Experience and Engagement was employed. This questionnaire was adapted from (Högberg, Hamari, & Wästlund, 2019).

Table 1: Number of Items for Each Dimension In Gamefulquest Questionnaire

Dimension	Items
Accomplishment	6 items
Challenge	5 items
Competition	6 items
Immersion	7 items
Playfulness	5 items
Social Experience	5 items
Engagement	7 items

Gamified learning experiences consist of six reflective constructs: accomplishment, challenge, competition, immersion, playfulness and social experience. This analysis aims to measure the relationship between the gamified experience and students’ engagement in the STATOPOLY game. The questionnaire consists of 41 items based on a 5-point Likert scale with verbal anchors of 5 (Strongly Agree), 4 (Agree), 3 (Neutral), 2 (Disagree) and 1 (Strongly Disagree). Immediately after the Statopoly game concluded, the questionnaires were given to the students via Google Forms.

Data Analysis

The collected data were analysed using SPSS for descriptive analysis. The mean and standard deviation of each construct were calculated separately for Nursing and Medical Sciences students. A normality test revealed that the data were not normally distributed. Therefore, for inferential analysis, the Mann-Whitney U test, a nonparametric test suitable for comparing two independent groups was employed to compare the distributions between Nursing and Medical

Sciences students (Ai, Huang, & Zhang, 2020). To examine the relationship between the gamified experience and students' engagement, Spearman's-rho correlation analysis was conducted.

For the inferential analysis, the hypotheses for this research are:

H_{01} : There is no significant difference in each construct among Nursing and Medical Sciences students.

H_{A1} : There is a significant difference in each construct among Nursing and Medical Sciences students.

H_{02} : There is no correlation between gamified learning experience and engagement.

H_{A2} : There is a correlation between gamified learning experience and engagement.

3. Results and Discussions

Reliability of the Questionnaire

Table 2 shows the Cronbach's alpha values for the level of reliability of the questionnaire. All six constructs for the gamified learning experience and engagement have values ranging from 0.833 to 0.898 which indicates high internal consistency.

Table 2: Reliability of The Questionnaire

Construct	No. of item	Cronbach's alpha value
Accomplishment	6	0.898
Challenge	5	0.833
Competition	4	0.855
Immersion	6	0.860
Playfulness	4	0.873
Social Experience	4	0.874
Engagement	5	0.892

Respondents' Background

Figure 1 shows the distribution of the samples according to gender. Among the respondents, 18% are male and 82% are female.

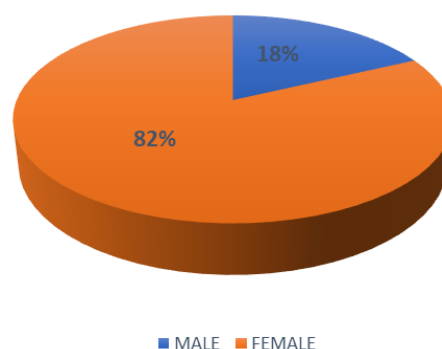


Figure 1: Respondents' Gender

Figure 2 shows the distribution of the samples by course. Of the respondents, 49% (57 students) are Nursing students while 51% (54 students) are Medical Sciences students.

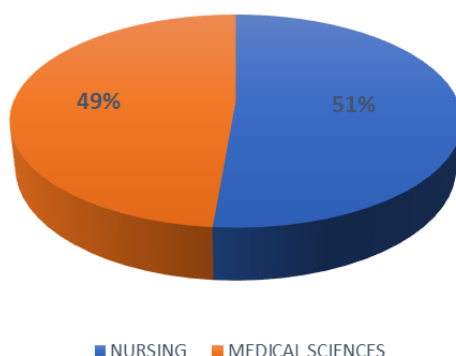


Figure 2: Respondents' Courses

Descriptive Analysis

Table 3 shows the mean scores for the gamified learning experience constructs and engagement across the courses. For Nursing students, the mean scores for the constructs of accomplishment, challenge, competition, immersion, playfulness, social experience and engagement were 4.84, 4.65, 4.71, 4.51, 4.75, 4.82 and 4.81 respectively. The mean scores for Medical Sciences students were 4.69, 4.64, 4.62, 4.42, 4.63, 4.57 and 4.54 respectively for the same seven constructs. Overall, Nursing students have higher mean scores for gamified learning experience constructs and engagement compared to the Medical Sciences students. This suggests that gamification elements, such as accomplishment, challenge, and social experience, significantly contribute to enhancing learner engagement and overall educational satisfaction. These findings align with existing research that highlights the positive impact of gamified learning on student engagement and academic motivation (Deterding, Dixon, Khaled, & Nacke, 2011).

Table 3: Descriptive Statistics for Six Constructs In Gamified Learning Experience And Engagement Across Courses.

	Course	N	Mean	Std. Deviation
Accomplishment	Nursing	57	4.8421	0.3077
	Medical	54	4.6944	0.3988
Challenge	Nursing	57	4.6456	0.5305
	Medical	54	4.6370	0.4275
Competition	Nursing	57	4.7105	0.4194
	Medical	54	4.6204	0.4826
Immersion	Nursing	57	4.5146	0.7191
	Medical	54	4.4198	0.4929
Playfulness	Nursing	57	4.7456	0.4519
	Medical	54	4.6250	0.4471
Social experience	Nursing	57	4.8246	0.3597
	Medical	54	4.5741	0.4774
Engagement	Nursing	57	4.8140	0.3603
	Medical	54	4.5407	0.4847

Figure 3 shows the comparison of mean scores for the Gamefulquest constructs between Medical Sciences and Nursing students. Overall, the Nursing students scored higher means compared to the Medical Sciences students. This indicates that Nursing students perceived Statopoly as more engaging, enjoyable, challenging and competitive. However, there is no clear conclusion in the research as to whether gamification has a greater effect on intrinsically

driven or extrinsically motivated learners in terms of the construct engaging, enjoyable, challenging and competitive (Alsawaier, 2018).

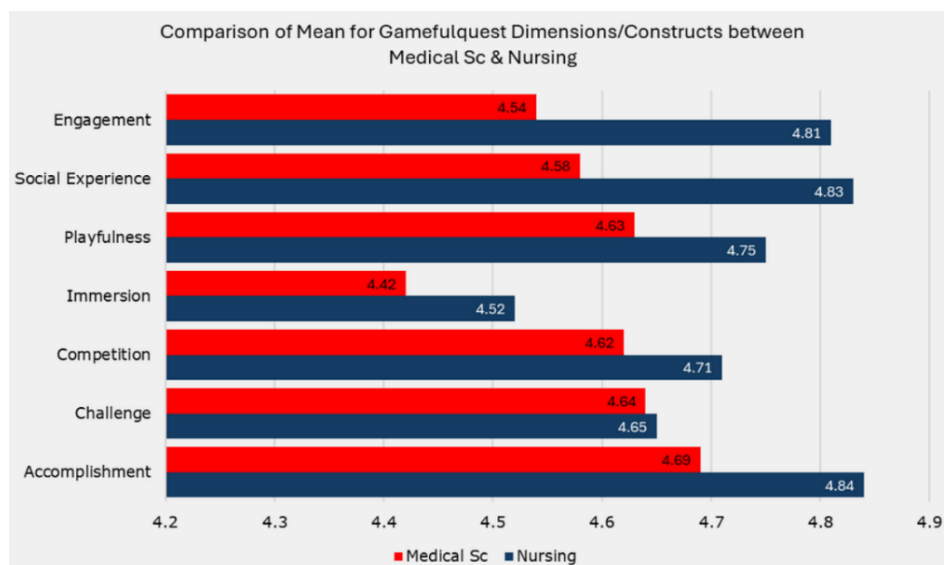


Figure 3: Mean Scores for The Six Constructs

Inferential Analysis

For inferential statistics, the Mann-Whitney U Test was used to compare the distribution of the six constructs across courses. The null hypotheses for all constructs were “There is no significant difference in each construct between Nursing and Medical Sciences students”. Table 4 shows that at the 5% significance level, there is a significant difference in the distribution of these constructs - accomplishment, immersion, playfulness, social experience and engagement - between the Nursing and Medical Sciences students. The p-values for these constructs were 0.023, 0.046, 0.046, 0.001 and 0.001 respectively, all less than 0.05. These significant differences indicate that the impact of gamified learning experiences can differ between student groups, which is consistent with previous studies highlighting how demographic and academic factors influence the effectiveness of gamification in educational settings (Anderson & Rainie, 2018). Meanwhile, for the constructs of challenge and competition, the p-values were 0.461 and 0.305 respectively, both greater than 0.05, meaning the null hypothesis is retained. This indicates that there is no significant difference for both constructs between Nursing and Medical Sciences students.

Table 4: Independent-Samples Mann-Whitney U Test for Accomplishment Across Courses.

	COURSE	N	Asymp. Sig. (2-tailed)	Decision
ACCOMPLISHMENT	Nursing	57	0.023	Reject H ₀
	Medical	54		
CHALLENGE	Nursing	57	0.461	Retain H ₀
	Medical	54		
COMPETITION	Nursing	57	0.305	Retain H ₀
	Medical	54		
IMMERSION	Nursing	57	0.046	Reject H ₀
	Medical	54		
PLAYFULNESS	Nursing	57	0.046	Reject H ₀
	Medical	54		
SOCIAL EXPERIENCE	Nursing	57	0.001	Reject H ₀
	Medical	54		
ENGAGEMENT	Nursing	57	0.001	Reject H ₀
	Medical	54		

Furthermore, a correlation analysis using Spearman's rho correlation coefficients was conducted to examine the relationship between gamified learning experience and engagement. The data interpretation is adopted from Dancey and Reidy (2014) as shown in Table 5.

Table 5: Interpretation of the level of relationship (Spearman's ρ)

Mean score	Interpretation
≥ 0.70	Very strong relationship
0.40-0.69	Strong relationship
0.30-0.39	Moderate relationship
0.20-0.29	Weak relationship
0.01-0.19	No or negligible relationship

Source: Dancey and Reidy (2014)

The null hypothesis was "There is no correlation between gamified learning experience and engagement". Table 6 shows the output from SPSS, where there is a strong positive correlation at 0.01 level ($\rho = 0.615$, p-value < 0.01) between gamified learning experience and engagement for Nursing students. For the Medical Sciences students, there was a very strong positive correlation ($\rho = 0.731$, p-value < 0.01) between both variables. This positive relationship suggests that implementing more gamified learning experiences will increase students' engagement. As suggested in the literature, effectively integrating game elements is crucial for fostering gamified learning experiences (Hamari et al., 2016). Tomaselli et al. observed similar outcomes, where overcoming challenges in games positively affected user engagement levels (Tomaselli, Sanchez, & Brown, 2015).

Table 6: Spearman's Rho Correlation Coefficients on Gamified Learning Experience and Students' Engagement

Spearman's rho	Gamified learning experience	Engagement	
		NURSING N = 57	MEDICAL N = 54
		0.615**	0.731**

**Correlation is significant at the 0.01 level (2-tailed)

4. Conclusion

Investigating the impact of gamified learning experiences on student engagement is essential for improving the teaching and learning of Statistics. The study's findings indicate that Nursing students consistently achieved higher mean scores across all six constructs of the gamified learning experience and engagement, indicating a more positive perception of Statopoly. These elevated scores suggest that Nursing students found the gamified learning experience more effective, engaging and enjoyable compared to the Medical Sciences students.

Results from the Mann-Whitney U Test reveal a significant difference between Nursing and Medical Sciences students in four constructs – accomplishment, immersion, playfulness and social experience, while no significant difference was found in two other constructs namely challenge and competition. These findings suggest that while Nursing and Medical Sciences students share similar views on the challenge and competition aspects of the gamified learning experience, their perceptions differ significantly in terms of accomplishment, immersion, playfulness and social experience, which implies that the impact of the gamified learning experience varies between the two groups for certain constructs.

Engagement is a crucial factor in implementing gamification in learning and therefore serves as an important measure of its effectiveness (Silpasuwanchai, Ma, Shigemasu, & Ren, 2016). In our study, the correlation analysis shows a strong positive correlation between gamified learning experience and engagement among the Nursing students, and a very strong positive correlation for Medical Sciences students. This indicates that while both groups show a positive relationship between gamified learning experience and engagement, Medical Sciences students experience an even stronger correlation, which means that they are more significantly impacted by the gamified learning experience via Statopoly in terms of their engagement levels compared to Nursing students.

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