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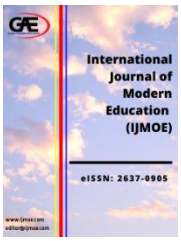

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GAMIFICATION AS A CATALYST FOR ENHANCED LEARNING AMONG UNIVERSITY STUDENTS

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Abstract:

Gamification, defined as the integration of game design elements into non-game learning contexts, has become an increasingly practical approach for enriching teaching and learning in higher education, particularly where digital activities and online games are part of instruction. This study re-examines gamification as a classroom strategy for enhancing university students' learning performance, using Self-Determination Theory and Flow Theory as design and interpretive lenses rather than as directly measured explanatory constructs. A quasi-experimental one-group pre-test/post-test design was conducted with an intact cohort of 27 undergraduate students enrolled in a non-technology course at a Malaysian public university. Over six weeks, points, badges, leaderboards, and interactive challenges were incorporated into regular learning activities. Academic achievement was assessed with a course-aligned short-answer test administered before and after the intervention. Data were analyzed in SPSS 26.0 using descriptive statistics, normality tests (Shapiro-Wilk and Shapiro-Francia), and a paired-samples t-test. The mean score rose by 17.90 points, from 63.27 (SD = 13.33) to 81.17 (SD = 10.23). The improvement was statistically significant, with a large within-subject effect size (dz = 1.05), according to the paired-samples t-test ($t(26) = 5.44$, $p < .001$). The results imply that short-term academic performance in higher education can be supported by a carefully planned gamification design. The paper highlights that theoretical assertions about motivation and flow should be understood cautiously when such characteristics are not directly quantified and

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provides contextual data from a non-technology course in a Malaysian public institution. Study limits, directions for more thorough future research, and implications for instructional design are also covered.

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Academic Performance, Enhanced Learning, Gamification, Higher Education, University Students

Introduction

Universities are implementing cutting-edge methods to promote student engagement and learning outcomes because of the move to technology-enhanced learning, which has completely changed the educational landscape. Among these is gamification, which has grown in popularity and is defined as the incorporation of features of game design, such as challenges, leaderboards, and points, into non-gaming situations (Deterding et al., 2011). As digital and online learning have taken off, the use of game-inspired strategies in education has become much more important. Today's students are spending more time learning through virtual platforms, so approaches that make lessons more interactive and engaging are especially valuable. This study draws on ten years of research and theory to explore how adding game elements—especially through online games—can help students learn better.

In order to increase student engagement and enhance learning outcomes, higher education institutions have been incorporating digital technologies more into their pedagogical techniques in recent years. Among these advances, gamification—the use of elements of game design in non-gaming contexts—has shown promise to improve university students' motivation, engagement, and retention of information (Deterding et al., 2011; Domínguez et al., 2013). Even if gamification is becoming increasingly popular, its efficacy in higher education is still up for debate, especially when it comes to various academic fields and learning settings (Seaborn & Fels, 2015; Subhash & Cudney, 2018).

Previous research has demonstrated that gamification can increase student happiness and engagement; however, many of these studies are constrained by small sample sizes, brief intervention times, and an emphasis on self-reported or subjective data (Hamari et al., 2014; Alsawaier, 2018). Furthermore, there is disagreement on the best gamification components

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(such as leaderboards, badges, and points) and the circumstances under which they yield the best learning results (Sailer et al., 2017).

Furthermore, there is a knowledge gap regarding the ways in which gamification affects learning processes because few studies provide a thorough theoretical framework connecting gamification to cognitive and behavioural learning theories (Landers, 2014). Although gamification has been extensively studied in corporate training and education, less is known about its use in higher education, especially when it comes to learner autonomy, long-term academic achievement, and the development of critical thinking (Kuo & Chuang, 2016).

Furthermore, little research has been done on the institutional, cultural, and technological aspects that affect gamification's effectiveness in a variety of academic contexts (Bai et al., 2020). In order to close these gaps, this study will analyse the contextual factors that influence gamification's success or limitations in higher education, determine which game elements have the greatest impact, and critically examine how gamification can act as a catalyst for enhanced learning among university students.

Thus, the purpose of this study is to close these gaps by analysing the contextual factors that influence the success or limitations of gamification in higher education, determining which game elements have the greatest impact, and critically examining how gamification can serve as a catalyst for improved learning among university students. This study also sheds some light on the outcomes of gamification in a Malaysian university's classroom.

Literature Review

Gamification and Learning in Higher Education

Since gamification can make learning assignments more visible, goal-directed, and participatory, it has been used in a variety of higher education contexts. According to studies (Antonaci et al., 2018; Khaldi et al., 2023), students are more likely to stay involved in the learning process when they receive prompt feedback, progression indications, and sufficiently challenging activities. Higher attendance, greater task completion, stronger time-on-task, and enhanced performance on theory-based or practical tests are among the positive results documented in the research (Domínguez et al., 2013; Subhash & Cudney, 2018).

The literature does, however, also imply that gamification is not always effective. According to Bai et al. (2020), contextual and design features are more important for gamification's success than just having game elements. Additionally, Sailer et al. (2017) demonstrate that various mechanics can meet various psychological needs, indicating the importance of each game element's educational goal. Hanus and Fox (2015) discovered that reward-heavy designs can have unforeseen repercussions when they promote social comparison without enough educational significance. As a result, the best research in this field views gamification as an organized instructional design choice rather than as decoration.

Self-Determination Theory and Flow Theory as Design Rationale

According to Self-Determination Theory, learners who feel competent, connected, and autonomous are more motivated (Ryan & Deci, 2000). These demands can be met in gamified learning settings when students connect with peers through cooperative or competitive

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activities, face manageable difficulties, and receive timely performance feedback. According to Flow Theory, people can become fully immersed in an activity when there is a balance between ability and challenge, clear goals, and instant feedback (Csikszentmihalyi, 1990). Through gradual challenges, apparent progress, and frequent practice chances, gamification may be able to establish such conditions.

These theories are purposefully used in a limited manner in this investigation. They are used to direct the intervention's design logic, such as by connecting increasingly difficult activities to flow conditions, social interaction to relatedness, and feedback and progress indicators to competence. However, autonomy, competence, relatedness, flow, and motivation are not measured directly in this study. Therefore, theories are not employed as empirically tested mediating variables but rather as an interpretive lens. This clarification is crucial because it maintains the analysis in line with the achievement statistics that were actually gathered and avoids conceptual overstatement.

Research Methodology

This study examined the effects of gamification on student learning outcomes using a quasi-experimental one-group pre-test and post-test approach. 27 undergraduate students enrolled in non-technology courses at a Malaysian public institution participated in the study. Purposive sampling, a technique frequently employed in educational research to examine naturally occurring groups, was utilized to choose the participants (Etikan, Musa, & Alkassim, 2016).

A standardized test was used to assess academic achievement before and after the gamification intervention. The test's short-answer questions matched the learning objectives of the course. Gamified components like points, badges, leaderboards, and interactive challenges were included into classroom exercises and distributed via the university's learning management system during the six-week intervention. This strategy is consistent with well-known gamification frameworks that highlight engagement and motivation through game design components (Deterding et al., 2011).

The software SPSS version 26.0 was used to analyse the data. Both the Shapiro-Wilk test and the Shapiro-Francia test, which are frequently advised for small sample sizes, were used as normality checks to make sure the paired sample t-test's assumptions were met (Razali & Wah, 2011). The pre-test and post-test scores were compared using a paired sample t-test with a significance level of $p < 0.05$ after the normal distribution was confirmed. This statistical method made it possible to conduct a thorough assessment of how well gamification improves students' academic performance.

Results and Discussion

A total of 27 undergraduate students participated in this study to evaluate the impact of gamification on academic performance through a pre-test and post-test design. Descriptive statistics, in Table 1, revealed that the mean pre-test score was 63.27 (with standard deviation of 13.33), while the mean post-test score increased to 81.17 (with standard deviation of 10.23), indicating a notable improvement in performance following the gamified intervention.

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Table 1: Descriptive Statistics

Test Score	Mean	Standard Deviation
Pre-test Score	63.27037	13.33289
Post-test Score	81.17407	10.23281

Source: Author's Tabulation

To assess the assumption of normality required for the paired sample t-test, both the Shapiro–Wilk and Shapiro–Francia tests were conducted, as shown in Table 2. For the Shapiro–Wilk test, the pre-test score ($W = 0.97275$, $p = 0.6757$) and post-test score ($W = 0.97704$, $p = 0.7903$) indicated no significant departure from normality. Similarly, the Shapiro–Francia test confirmed normal distribution for both pre-test ($W' = 0.96166$, $p = 0.3417$) and post-test scores ($W' = 0.98971$, $p = 0.9765$). These findings support the appropriateness of using a paired sample t-test for further analysis (Razali & Wah, 2011).

Table 2: Result of Normality Test

	Shapiro–Wilk W Test				Shapiro–Francia W' Test			
Test Score	**W**	**V**	**z**	**p-value**	**W'**	**V'**	**z**	**p-value**
Pre-test Score	0.97275	0.801	-0.456	0.67566	0.96166	1.251	0.408	0.34170
Post-test Score	0.97704	0.675	-0.807	0.79025	0.98971	0.336	-1.987	0.97654

Source: Author's Tabulation

Table 3 revealed that there is an improvement in post-test scores following the gamification intervention indicates a positive influence of gamified learning environments on students' academic achievement. This is in line with research by Domínguez et al. (2013), who found that students performed better in classes that included game-based components. The significant rise in mean scores (17.90 points) highlights the motivational potential of gamification to promote increased engagement and enhanced retention of information (Subhash & Cudney, 2018). Students' interest and engagement, which are known to contribute to successful learning, were probably improved by the planned incorporation of rewards, challenges, and interactive features (Deterding et al., 2011; Khaldi et al., 2023).

Basic theories of education provide additional support for these results. Self-Determination Theory states that learning is most successful when students feel competent, autonomous, and connected conditions that are frequently satisfied in gamified environments through features like social engagement, progress tracking, and instant feedback (Ryan & Deci, 2000). For the best learning outcomes, immersive and captivating experiences are crucial, according to Flow Theory (Csikszentmihalyi, 1990). These theoretical ideas are well-aligned with gamification, which helps turn passive learning into active discovery by making learning more engaging and dynamic.

However, care should be taken when interpreting these findings. Drawing conclusions about causality is limited because the study used a one-group pre-test/post-test design without a control group. Furthermore, in line with Hanus and Fox's (2015) concerns, an excessive focus on extrinsic rewards—such as leaderboards or badges—may jeopardize intrinsic motivation if they are not well matched with educational goals. To further understand the long-term effects of gamification on learning, future study should take into account including control groups,

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evaluating long-term learning outcomes, and investigating motivational shifts using qualitative methodologies.

Table 3: Result Of Paired Samples T-Test Which Compares the Mean of Pre-Test and Post-Test Score on Gamification.

Test Score	Mean	Std Error	Std Dev.	95% Conf Interval	
Pre-test Score	81.17407	1.969306	10.23281	77.12611	85.22204
Post-test Score	63.27037	2.565916	13.33289	57.99605	68.54469
Diff	17.9037	3.291492	17.10309	11.13795	24.66946

mean(diff) = mean(postscore - prescore) t = 5.4394
H0: mean(diff) = 0 Degrees of freedom = 26
Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 1.0000 Pr(|T| > |t|) = 0.0000 Pr(T > t) = 0.0000
Source: Author's Tabulation

Discussion

According to the results, student achievement improved following the gamification intervention. This pattern is in line with earlier research demonstrating that when gamified learning environments are incorporated into meaningful coursework rather than being used as superficial add-ons, they can enhance participation, focus, and assessment performance (Domínguez et al., 2013; Subhash & Cudney, 2018; Khaldi et al., 2023). The combination of progress visibility, frequent feedback, and interactive challenges in this study may have improved students' focus on learning activities and promoted longer-term engagement with the course material.

The theoretical interpretation must, however, continue to be in line with the available data. The results should not be interpreted as direct evidence that these constructs changed because the study did not evaluate autonomy, competence, relatedness, flow, or motivation. The observed performance improvements are consistent with the motivational reasoning put out by Self-Determination Theory and Flow Theory, which is a more plausible explanation. In other words, although the intervention was created in a way that could perhaps facilitate social engagement, competency feedback, and suitably difficult learning situations, the available data do not empirically support those mechanisms.

The study design must also be considered while evaluating the outcomes. For exploratory classroom evaluation, a one-group pre-test/post-test method is helpful, but it cannot rule out competing hypotheses like practice effects, improved familiarity with the assessment format, or other concurrent teaching factors. Therefore, rather than providing conclusive proof that gamification alone created the observed increases, the study offers evidence of instructional utility in an actual classroom setting.

Contributions to Knowledge and Practice

By elucidating the appropriate application of motivational theory in performance-focused gamification research, this study makes a small but valuable theoretical contribution. The revised manuscript takes a more rigorous stance: theory can guide intervention design and interpretation, but direct theory testing necessitates direct measurement of the pertinent constructs. This is in contrast to treating Self-Determination Theory and Flow Theory as

automatically verified whenever gamification is applied. In small-scale classroom experiments, this improved alignment lessens conceptual overreach.

Additionally, the study contributes methodologically and contextually. Most of the empirical research on gamification is still found in highly digital or technology-oriented learning contexts. The study expands the body of data to a less well-documented situation by analysing a full class in a non-technology subject at a public institution in Malaysia. By describing the available population, explaining the usage of the instruments, fixing the descriptive reporting error in the original table, and including the mean difference, confidence interval, and effect size in addition to the significance test, the paper enhances methodological transparency.

Essentially, the results indicate that teachers are more likely to gain from gamification when game components are closely linked to course learning objectives, offer prompt feedback, and facilitate intentional engagement. The findings suggest gamification as a purposeful pedagogical approach that, when appropriately matched with evaluation and teaching objectives, may make progress apparent and encourage active learning rather than gamification as novelty for its own sake.

Limitations and Future Research

There are a few limitations to be aware of. First, generalizability and causal inference are limited by the study's use of a single classroom cohort of 27 children and lack of a control group. Second, despite being regularly administered and in line with the learning objectives, the outcome measure—a course-based achievement test—lacked a distinct pilot reliability coefficient. Third, the study did not assess learner motivation, delayed retention, or students' opinions of the gamified experience; instead, it concentrated on short-term performance change.

Wider and more varied samples, comparison groups or randomized designs when possible, and a wider range of outcome measures should all be used in future studies. In order to test rather than infer the mechanisms proposed by the current study, it would be especially beneficial for future research to measure autonomy, competence, relatedness, flow, and motivation directly. Additionally, delayed post-tests and mixed-method designs would improve knowledge of whether gamification primarily results in short-term engagement effects or long-term learning benefits.

Conclusion

The beneficial effects of gamification on students' academic performance in a university setting are empirically supported by this study. The notable increase in post-test results indicates that well-thought-out gamified learning environments can boost students' motivation, engagement, and retention of information. Teachers can design more dynamic and student-centred learning experiences that are in line with modern pedagogical ideas like Self-Determination Theory and Flow Theory by including game features like rewards, feedback, and interactive challenges.

Although the results are encouraging, the study's limitations—such as its one-group pre-test/post-test design and comparatively small sample size—highlight the need for more investigation. To gain a deeper understanding of the long-term impacts and motivational

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mechanisms of gamification in education, future research should use more rigorous experimental designs involving control groups, longitudinal tracking, and qualitative insights. All things considered, the findings add to the expanding corpus of research endorsing gamification as a successful teaching tactic. Gamification has the power to make traditional education more effective, inclusive, and engaging when it is in line with specific learning objectives and student needs

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