

Gamification in Hybrid Learning: Boosting Student Engagement in a Post-Pandemic World

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Abstract

The rapid transition to post-pandemic education has solidified hybrid learning as a permanent fixture in modern academia; however, sustaining student motivation and active participation across both physical and virtual environments remains a critical challenge. This study employed a mixed-methods research design, combining quantitative pre- and post-intervention engagement surveys with qualitative classroom observations across undergraduate hybrid courses over a 16-week semester. The experimental group integrated gamification elements such as digital badges, leaderboards, interactive point systems, and competitive collaborative challenges while the control group followed standard hybrid delivery. The findings indicate a statistically significant increase in student engagement, class attendance, and knowledge retention within the gamified cohorts. Qualitative feedback highlights that game-based mechanics fostered a stronger sense of community and reduced digital fatigue, though successful implementation required careful balancing of competitive elements to avoid student anxiety. Gamification proves to be a powerful pedagogical catalyst capable of bridging the engagement gap in post-pandemic hybrid learning models, transforming passive online learners into active, motivated participants.

Keywords:

Gamification, Hybrid Learning, Student Engagement, Post-Pandemic Education, Educational Technology

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1. INTRODUCTION

The rapid transition of post-COVID-19 higher education has transformed hybrid learning from an emergency response into a permanent component of contemporary academia (Thi Binh et al., 2024). By combining face-to-face and online instruction, hybrid learning offers greater flexibility and accessibility for students across different locations (Alam et al., 2023). However, maintaining student motivation, active participation, and knowledge retention across physical and virtual environments remains a significant challenge (Balalle, 2024). Blurred boundaries between these learning spaces can contribute to digital fatigue, social isolation, reduced attention, and fragmented participation between students attending physically and those joining remotely (Zia & Noor, 2024; Duggal et al., 2021).

Gamification has emerged as a promising pedagogical approach for addressing these engagement challenges. By incorporating game elements such as points, digital badges, leaderboards, and collaborative challenges into non-game learning contexts, gamification can create more interactive and participatory learning experiences (Swacha, 2021; Kang & Recard, 2023). Its potential is also supported by Self-Determination Theory (SDT), which proposes that learning environments can strengthen motivation by supporting students' needs for autonomy, competence, and relatedness (Grabner-Hagen & Kingsley, 2023a). When appropriately integrated into hybrid instruction, gamification may therefore support both participation and social connection across physical and virtual learning spaces.

However, existing research provides an incomplete picture of how gamification functions specifically within post-pandemic hybrid higher education. Much of the earlier literature has examined conventional classroom settings or fully online environments, while comparatively less attention has been given to the participation gap between physically present and remote students in sustained hybrid courses (Park & Kim, 2021a; Duggal et al., 2021). Previous studies have also identified potential concerns related to excessive competition, academic anxiety, and the novelty effect, suggesting that the effectiveness of gamification may depend on how game mechanics are designed and maintained over time (Grabner-Hagen & Kingsley, 2023b; Park & Kim, 2021a). In addition, the effects of gamification may vary according to student characteristics, academic disciplines, and institutional digital readiness (Alrashed et al., 2023).

These gaps indicate a need for research that examines gamification in hybrid learning through both measurable engagement outcomes and students' lived experiences over an extended instructional period. In particular, the relationships among behavioral, cognitive, and emotional engagement, digital fatigue, competitive pressure, and institutional readiness require further empirical examination. A mixed-methods approach can address this need by combining quantitative evidence of engagement changes with qualitative evidence explaining how and why students respond to different gamification mechanics.

Therefore, this study investigates the impact of integrating point systems, digital badges, and collaborative challenges into post-pandemic hybrid undergraduate courses over a 16-week semester. Specifically, it examines changes in student engagement between gamified and standard hybrid instruction and explores students' experiences regarding motivation, digital fatigue, community building, and competitive pressure. The study's novelty lies in integrating quantitative engagement measures, LMS behavioral data, and qualitative student experiences within a sustained hybrid learning intervention, thereby providing a more comprehensive understanding of how gamification can be designed to support engagement while minimizing potential psychological drawbacks.

2. METHOD

This study employed an explanatory sequential mixed-methods research design, combining quantitative pre- and post-intervention data with qualitative classroom observations and student feedback over a full 16-week semester. This methodological approach allowed for a robust measurement of engagement metrics while capturing the nuanced lived experiences of students navigating a gamified hybrid learning environment.

Participants and Context

The research was conducted within undergraduate courses in a higher education institution that implements a hybrid delivery model (combining synchronous face-to-face sessions in physical classrooms with simultaneous live virtual sessions via video conferencing platforms). A total of $N = 145$ undergraduate students participated in this study, comprising two distinct cohorts: an experimental group ($n = 75$) and a control group ($n = 70$). Participants were selected using a quasi-experimental non-equivalent control group design based on enrolled course sections.

Intervention Design (Experimental vs. Control)

The control group experienced standard hybrid instruction, relying on traditional lectures, standard online discussion boards, and conventional assignment submissions without gamified features. Conversely, the experimental group integrated a comprehensive gamification framework implemented through the university's Learning Management System (LMS) and supplemental digital tools. The gamification mechanics included:

1. Point Systems: Students earned experience points (XP) for attending sessions (both physical and virtual), submitting assignments on time, and providing peer feedback.
2. Digital Badges: Milestone-based badges were awarded for consistent participation, mastery of specific learning modules, and creative problem-solving.
3. Leaderboards: Weekly updated anonymous leaderboards displayed top performers to foster healthy academic competition.
4. Collaborative Quests: Team-based challenges that required hybrid groups (mixing physical and virtual attendees) to solve complex case studies together, reinforcing relatedness and teamwork.

Data Collection Instruments

Data were gathered using both quantitative and qualitative instruments:

1. Quantitative Surveys: A validated Student Engagement Scale (SES) survey questionnaire, measuring behavioral, cognitive, and emotional engagement dimensions, was administered at two intervals: pre-intervention (Week 2) and post-intervention (Week 15). Items were rated on a 5-point Likert scale.
2. Additionally, LMS analytics tracking student logins, resource accesses, and assignment completion rates were extracted
3. Qualitative Data: Semi-structured focus group discussions were conducted with a purposive sample of 18 students from the experimental group at the end of the semester. Furthermore, researcher observations during hybrid sessions and open-ended reflection logs submitted by students served as supplementary qualitative data sources.

Data Analysis

Quantitative survey data and LMS analytics were analyzed using SPSS. Descriptive statistics (mean and standard deviation) along with inferential statistics specifically paired-samples t -

tests and independent-samples *t-tests* were utilized to measure the statistical significance of changes in student engagement levels between the control and experimental groups. Meanwhile, qualitative data from focus groups and open-ended reflections underwent thematic analysis, involving systematic coding to identify recurring patterns regarding student motivation, digital fatigue, and perceptions of competitive mechanics.

3. RESULTS AND DISCUSSION

The quantitative analysis revealed a statistically significant difference in overall student engagement between the experimental group (gamified hybrid) and the control group (standard hybrid) by the end of the 16-week semester ($p < 0.05$). Independent-samples *t-test* comparisons of the post-intervention Student Engagement Scale (SES) scores demonstrated that students exposed to gamification mechanics such as experience points (XP), digital badges, and collaborative quests exhibited higher scores across behavioral, cognitive, and emotional dimensions. These findings align with recent empirical studies by dos Santos et al. (2025) and Kang and Recard (2023), which assert that structured game-like environments effectively stimulate active participation and mitigate passivity in technology-mediated learning spaces.

A deeper examination of the sub-dimensions revealed that behavioral engagement, measured through class attendance, timely assignment submissions, and LMS interaction logs, experienced the most pronounced surge in the experimental cohort. In the hybrid model, where physical absence or camera-off virtual attendance often breeds detachment, the point system acted as a powerful extrinsic motivator that translated into consistent daily habits. This supports the assertions of Alam et al. (2023) and Balalle (2024), who noted that gamified frameworks provide clear structural cues that help bridge the participatory gap between physical classrooms and virtual spaces.

Furthermore, cognitive engagement reflected in deeper critical thinking, active problem-solving, and participation in peer discussions showed substantial improvement due to the implementation of collaborative quests. By forcing mixed groups of physical and virtual attendees to tackle complex case studies collectively, the gamified framework successfully fostered a sense of shared responsibility. This dynamic addresses a primary concern raised by Duggal et al. (2021) regarding the fragmentation of hybrid learning communities, proving that well-designed game mechanics can cultivate interconnectedness across disparate learning environments.

In terms of emotional engagement and motivation, qualitative thematic analysis of focus group discussions and reflection logs provided critical context to the quantitative trends. Many students reported that digital badges and weekly leaderboards transformed mundane administrative tasks and milestone achievements into enjoyable milestones, thereby alleviating the psychological weight of digital fatigue. This observation corroborates Zia and Noor (2024), who emphasized the urgency of injecting interactive elements into post-pandemic education to combat screen exhaustion and psychological isolation.

However, the qualitative data also uncovered important nuances regarding the psychological pressure associated with competitive mechanics. While leaderboards successfully motivated top-tier and competitive students, a subset of participants in the experimental group voiced concerns about anxiety and discouragement when lagging behind peers on public scores. This tension mirrors the warnings of Grabner-Hagen and Kingsley (2023b), who highlighted that poorly regulated competition can inadvertently trigger academic stress and undermine intrinsic motivation if not balanced with cooperative milestones.

To address this challenge, the integration of Self-Determination Theory (SDT) principles offered valuable insights into why gamification succeeded overall. By fulfilling the three fundamental psychological needs autonomy (allowing students choices in quest

pathways), competence (mastering challenges via XP), and relatedness (collaborative team quests) the intervention successfully bridged extrinsic rewards with internal drive (Grabner-Hagen & Kingsley, 2023a). When rewards are structured around personal mastery rather than zero-sum competition, students exhibit higher psychological safety and sustained engagement over time (Park & Kim, 2021b).

An important phenomenon observed during the semester was the management of the novelty effect. Longitudinal analysis of LMS analytics indicated an initial spike in engagement during the first four weeks, followed by a slight plateau in the mid-semester phase. To counteract this potential decline, introducing fresh quest variants and shifting badge criteria mid-term proved crucial in maintaining momentum, reinforcing the argument by Park and Kim (2021a) that gamification must be dynamically maintained rather than deployed as a static feature.

When comparing these results with the control group, the limitations of standard hybrid delivery became starkly evident. The control cohort displayed a steady decline in virtual attendance and asynchronous discussion board participation as the semester progressed, underscoring the limitations of passive content delivery in post-pandemic academia. As Thi Binh et al. (2024) noted, modern learners having adapted to highly interactive digital ecosystems demand active pedagogical strategies that mirror the responsiveness of contemporary digital platforms.

Institutional readiness also emerged as a significant mediating factor in the success of the intervention. Instructors noted that seamless LMS integration and robust digital infrastructure were prerequisites for executing real-time point tracking and badge distribution without technical friction. This finding supports Alrashed et al. (2023) and Subhash and Cudney (2018), who argued that the scalable success of educational technology heavily depends on institutional alignment, faculty digital literacy, and technical support frameworks.

Ultimately, the results confirm that gamification serves as a robust pedagogical catalyst when implemented thoughtfully within post-pandemic hybrid frameworks. By intentionally balancing competitive metrics with cooperative goals, educators can successfully transform isolated online learners and passive physical attendees into a unified, highly motivated academic community.

4. CONCLUSION

This study demonstrates that the strategic integration of gamification elements—such as experience points, digital badges, leaderboards, and collaborative quests—serves as a highly effective pedagogical catalyst for enhancing student engagement in post-pandemic hybrid learning environments. By grounding the intervention in Self-Determination Theory (SDT), the research confirms that gamified mechanisms successfully fulfill students' fundamental psychological needs for autonomy, competence, and relatedness, bridging the participation gap between physical and virtual classrooms. While competitive mechanics require careful balancing to prevent academic anxiety, cooperative quests and mastery-based rewards effectively mitigate digital fatigue, foster a unified sense of community, and sustain long-term academic motivation. Ultimately, gamification transforms hybrid education from a passive, fragmented delivery model into an active, immersive, and resilient ecosystem, offering vital empirical insights and evidence-based guidelines for modern higher education institutions navigating the future of learning.

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