

## RESEARCH ARTICLE

# Gamification in Mobile Learning Enhancing Engagement and Retention through Interactive Design

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**Abstract**

This study investigates the effectiveness of gamification in mobile learning environments in enhancing student engagement and knowledge retention within higher education institutions in Nepal. A mixed-methods design was adopted, combining quantitative and qualitative analyses among 120 undergraduate students from Tribhuvan University and its affiliated colleges. The experimental group used gamified mobile applications incorporating points, badges, leaderboards, and collaborative challenges, while the control group relied on standard mobile learning tools. Statistical results revealed substantial gains in engagement (from 3.2 to 4.3 on a five-point scale) and retention (from 62.4% to 78.6%) among students exposed to gamified platforms, with differences confirmed as significant ( $p < 0.001$ ). Thematic analysis indicated that gamification fostered motivation, reduced learning stress, and encouraged teamwork through interactive experiences. These findings suggest that gamified mobile learning not only improves academic outcomes but also promotes social interaction and sustained participation, particularly in Nepal's multilingual and culturally diverse classrooms. The study concludes that incorporating gamification into mobile learning can create a more active, inclusive, and enjoyable educational environment, supporting long-term learner engagement and cognitive development.

**Keywords**

Gamification; Mobile Learning; Engagement; Retention; Nepal.

## 1 | INTRODUCTION

In recent years, the integration of gamification into mobile learning has emerged as a promising pedagogical strategy to enhance student engagement and knowledge retention. As mobile technology becomes increasingly prevalent in Nepal's educational institutions, gamified approaches offer new opportunities to create interactive and motivating learning experiences. Gamification applies game-design features—such as challenges, feedback loops, and rewards—within educational settings to transform conventional learning into more dynamic, participatory processes (Nobre & Nobre, 2022; Díaz *et al.*, 2022). Empirical research indicates that features like missions, point systems, and badges significantly stimulate motivation and participation, ultimately improving learning outcomes (Sani & Ratri, 2024; Sujarwo & Rejekiingsih, 2023). Popular mobile platforms such as *Kahoot* and *Quizizz* exemplify how competitive and reward-based designs can foster sustained attention and a sense of accomplishment among learners (Nobre & Nobre, 2022; Alenezi, 2023). Gamified learning environments also facilitate experiential engagement and skill retention through repeated interaction and feedback cycles (Bolatbek *et al.*, 2025; Dymora *et al.*, 2021). Beyond motivation, studies show

that gamification enhances linguistic and cognitive development, which is particularly relevant for Nepal's multilingual education system, where students often learn in diverse linguistic contexts (Yang *et al.*, 2024; Sandy *et al.*, 2021; Safitri & Tari, 2022). Research further underscores the value of mobile gamification in promoting collaborative learning and social interaction, as seen in approaches such as the Team Games Tournament (TGT), which encourages cooperation and reduces classroom disengagement (Sujarwo & Rejkiningsih, 2023; Raja & Nordin, 2024). Additionally, the use of gamified mobile tools aligns with constructivist principles by supporting active learning and continuous feedback—key factors in sustaining motivation and comprehension (Ikpai, 2025; Gaalen *et al.*, 2020). Considering these insights, the adoption of gamification in Nepalese mobile learning contexts presents a valuable opportunity to strengthen learner participation, improve retention, and foster inclusive, technology-driven education practices. Consequently, this study examines the effectiveness of gamification in mobile learning environments in Nepal, focusing on how interactive design strategies can enhance engagement and long-term knowledge acquisition.

## 2 | BACKGROUND THEORY

Gamification in mobile learning offers a contemporary pedagogical approach that enhances learner engagement and knowledge retention by integrating game-design principles into educational environments. Its effectiveness is grounded in cognitive and educational theories that emphasize active participation, motivation, and feedback. The constructivist framework, in particular, posits that learners develop understanding through meaningful interaction and experiential engagement (Ikpai, 2025). This theoretical stance aligns closely with gamified learning, where students acquire knowledge through challenges, feedback loops, and self-directed exploration, thereby strengthening retention and motivation (Zhang & Hasim, 2023). Gamification commonly employs features such as points, badges, leaderboards, and narrative progression to foster a sense of achievement and intrinsic motivation (Ouanes, 2024). When integrated with mobile learning, these elements create flexible and responsive environments that encourage continuous participation regardless of time or place (Λαμπρόπουλος *et al.*, 2023; Amri & Almaiah, 2020). Empirical evidence indicates that such design elements can significantly increase learners' engagement levels, particularly when they are aligned with clear learning goals and provide immediate feedback (Sujarwo & Rejkiningsih, 2023).

In addition to enhancing individual motivation, gamification promotes collaborative learning by encouraging teamwork, communication, and problem-solving. Approaches such as the Team Games Tournament (TGT) model have demonstrated success in improving students' social and cooperative skills when embedded in mobile learning environments (Sujarwo & Rejkiningsih, 2023). This collaborative dimension reduces isolation and builds peer-to-peer interaction, an aspect increasingly valued in 21st-century education. Empirical research supports these theoretical perspectives by showing that gamified learning positively influences academic performance and cognitive outcomes. Revisiting educational materials through interactive game mechanics improves comprehension and memory retention by leveraging repetition and engagement (Gaalén *et al.*, 2020; Dustman *et al.*, 2021). Moreover, gamification fosters a constructive competitive atmosphere that sustains motivation and achievement over time (Alenezi, 2023; Λαμπρόπουλος & Sidiropoulos, 2024).

Nonetheless, the impact of gamification can vary depending on design quality, learner diversity, and instructional context. Some studies suggest that its motivational benefits may decline if game features are not meaningfully integrated or if novelty effects fade (Torresan & Hinterhuber, 2023; Xu *et al.*, 2023). This highlights the need for deliberate pedagogical planning to ensure that gamified systems support long-term learning objectives rather than short-term engagement. In summary, the theoretical and empirical foundations suggest that gamification, when thoughtfully embedded in mobile learning, holds strong potential to enhance student participation, reinforce knowledge retention, and cultivate collaborative learning cultures. By aligning constructivist principles with interactive digital design, educators can develop immersive learning experiences that resonate with the expectations and learning behaviors of contemporary students.

## 3 | METHOD

This study employed a mixed-methods design to investigate the effectiveness of gamification in mobile learning environments within the educational context of Nepal. The methodological framework integrated quantitative and qualitative approaches to capture statistical evidence of engagement and retention alongside participants' subjective experiences. The research was conducted across selected higher education institutions in Kathmandu, focusing primarily on Tribhuvan University and its affiliated colleges, where the use of mobile technology in academic activities is increasingly widespread. A quasi-experimental design was applied,

incorporating both pre- and post-intervention assessments to evaluate the influence of gamified mobile learning tools on student outcomes. To complement the quantitative data, semi-structured interviews were conducted to gather detailed insights into learners' perceptions of interactive design features. This dual strategy provided a comprehensive understanding of how gamification affects learning behaviors among students with diverse linguistic and disciplinary backgrounds. The study involved 120 undergraduate students aged between 18 and 25 years, selected through purposive sampling. Participants were evenly divided into two groups: an experimental group of 60 students who used gamified mobile learning applications and a control group of 60 students who engaged with traditional mobile learning resources without gamification features. The sample was balanced in terms of gender and academic fields to ensure representativeness across the student population. Data were collected using three primary instruments. First, an engagement survey based on a five-point Likert scale measured students' attention, participation, and motivation throughout the learning process. Second, a retention test assessed knowledge recall and conceptual application before and after the intervention to evaluate learning retention. Third, an interview guide containing open-ended questions explored participants' experiences with gamified elements such as rewards, challenges, and collaborative features.

The intervention spanned eight weeks. The experimental group interacted with mobile learning applications incorporating points, badges, and leaderboards to stimulate motivation and friendly competition. Platforms such as *Kahoot* and a locally developed gamified application were utilized, while the control group accessed identical instructional content through non-gamified mobile interfaces to maintain consistency. Both groups attended regular classes alongside their respective mobile learning activities. The research process unfolded in three sequential phases. The pre-intervention phase involved administering baseline surveys and retention tests, along with the collection of demographic data. During the intervention phase, engagement levels were monitored bi-weekly through surveys to track variations in participation and interest. In the post-intervention phase, final assessments and interviews were conducted, with 20 students from the experimental group selected for in-depth discussions about their gamified learning experiences. Quantitative data were analyzed using SPSS version 26, applying paired t-tests to examine within-group differences and independent t-tests to compare outcomes between the experimental and control groups. Qualitative data were subjected to thematic analysis to identify recurring themes and unique perspectives on gamification's impact on learning engagement and retention. Triangulation of both data types strengthened the validity of the findings and minimized potential bias. Ethical procedures were rigorously followed throughout the study. Informed consent was obtained from all participants, ensuring that they clearly understood the purpose and structure of the research. Participant anonymity was protected through the use of coded identifiers rather than personal names. Ethical approval was secured from the Tribhuvan University Research Ethics Committee, and all procedures adhered to institutional standards for studies involving human participants. Overall, the methodological design provided a balanced and transparent framework for evaluating the role of gamified mobile learning in improving engagement and retention. Adjustments made during implementation were carefully documented to ensure procedural integrity and enhance the reliability of the research outcomes.

## 4 | RESULTS AND DISCUSSION

### 4.1 Results

The analysis of data collected from 120 undergraduate students at Tribhuvan University and its affiliated colleges revealed significant differences in engagement and retention between the experimental group, which utilized gamified mobile learning tools, and the control group, which engaged with non-gamified mobile resources. Quantitative and qualitative data consistently demonstrated that the integration of gamified elements significantly enhanced learning outcomes. Engagement levels increased markedly among participants in the experimental group throughout the eight-week intervention. The mean engagement score rose from 3.2 (SD = 0.5) in the pre-intervention phase to 4.3 (SD = 0.4) post-intervention on a 5-point Likert scale. In contrast, the control group's engagement scores remained nearly unchanged, increasing only slightly from 3.1 (SD = 0.6) to 3.3 (SD = 0.5). Statistical testing supported these observations: a paired t-test confirmed significant improvement within the experimental group ( $t(59) = 8.45, p < 0.001$ ), and an independent t-test demonstrated a clear difference between the two groups following the intervention ( $t(118) = 6.72, p < 0.001$ ). Similarly, results from the retention tests indicated notable improvement in the experimental group's ability to recall and apply learned concepts. Before the intervention, mean retention scores were comparable between groups, with the experimental group averaging 62.4% (SD = 8.1) and the control group 61.8% (SD = 7.9). Post-intervention, the experimental group's mean score increased substantially to 78.6% (SD = 6.3), whereas the control group's score showed only a modest rise to 65.2% (SD = 7.5). Independent t-tests confirmed that these post-intervention differences were statistically significant ( $t(118) = 7.89, p < 0.001$ ). Qualitative data reinforced these quantitative findings. Thematic analysis of interviews conducted with 20 participants from the experimental group revealed three dominant themes: heightened

motivation resulting from reward-based systems (badges, points, and rankings), a strong preference for collaborative activities such as team-based challenges, and reduced learning-related stress attributed to the interactive and playful nature of gamified learning. Many students expressed that features like leaderboards fostered a sense of friendly competition and achievement, creating an environment that encouraged active participation and persistence—findings consistent with prior research on gamified motivation (Alenezi, 2023).

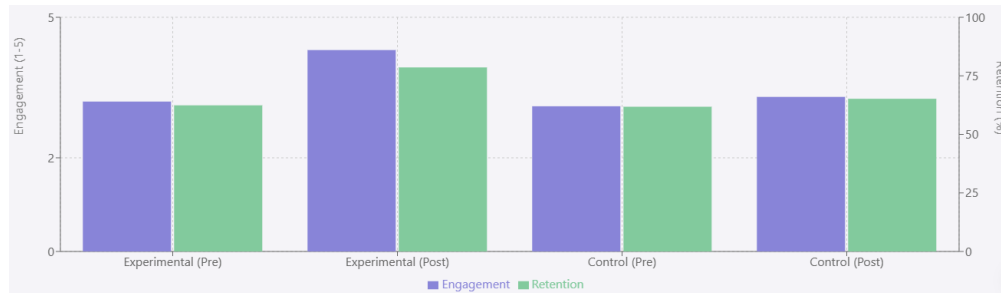


Figure 1. Comparison of Engagement and Retention Scores

The bar chart compares the pre- and post-intervention results for both the experimental and control groups across two metrics: engagement (Likert 1–5) and retention (%). Purple bars represent *engagement*, while green bars represent *retention*. The chart clearly shows that the experimental group experienced substantial gains in both engagement (from 3.2 to 4.3) and retention (from 62.4 to 78.6 percent), whereas the control group showed only minimal improvement (engagement 3.1 to 3.3; retention 61.8 to 65.2). These results visually affirm the positive influence of gamification on active participation and knowledge retention.

#### 4.2 Discussion

The findings demonstrate that integrating gamification into mobile learning significantly enhances student engagement and retention, particularly within the Nepalese higher education setting. The marked increase in engagement levels among the experimental group supports earlier research showing that game-based mechanics—such as points, leaderboards, and rewards—stimulate active learning and intrinsic motivation (Alenezi, 2023; Díaz *et al.*, 2022). These results suggest that gamified mobile learning transforms traditionally passive study habits into dynamic, participatory experiences that sustain learner interest over time. Improvement in retention outcomes further corroborates the view that repeated and interactive engagement strengthens memory consolidation and comprehension (Dymora *et al.*, 2021). The findings align with cognitive learning theories emphasizing reinforcement and feedback as central to long-term knowledge retention. Moreover, qualitative feedback underscored that students experienced lower stress and greater enjoyment, which likely contributed to improved performance—an observation consistent with studies linking positive emotional experiences to academic persistence (Yang *et al.*, 2024). The study also highlights the social dimension of gamification. Participants reported that collaborative challenges and team-based tasks enhanced their sense of connection and shared responsibility for learning. This observation aligns with findings from Sujarwo and Rejekiningsih (2023), who argue that gamified collaboration promotes communication, problem-solving, and collective engagement. These social benefits are particularly valuable in educational systems such as Nepal's, where classroom participation and peer learning are often constrained by traditional pedagogical methods (Sulaksono *et al.*, 2024).

While the experimental group demonstrated substantial gains, the control group's modest improvements suggest that mobile learning alone—without gamified components—still offers certain advantages, particularly in accessibility and content exposure. This indicates that gamification enhances but does not replace the inherent benefits of mobile learning, reflecting the nuanced perspective noted by Λαμπρόπουλος and Sidiropoulos (2024) in longitudinal studies comparing gamified and conventional instructional models. Nevertheless, limitations must be acknowledged. The eight-week intervention period may not fully capture the sustainability of gamification's impact over longer durations. As Torresan and Hinterhuber (2023) emphasize, initial motivation spikes may diminish without continuous design adaptation. Future studies should therefore extend intervention timelines and explore long-term behavioral changes, as well as culturally tailored gamified strategies adapted to Nepal's linguistic and educational diversity (Amri & Almaiah, 2020). In sum, the results affirm that gamified mobile learning can significantly strengthen student motivation, engagement, and retention when designed with pedagogical intent. By embedding interactive and competitive features within mobile platforms, educators can cultivate an active learning culture that enhances academic outcomes and promotes social collaboration. These findings contribute to the growing body of evidence advocating gamification as an effective educational innovation capable of reshaping learning experiences in technology-driven classrooms.

## 5 | CONCLUSIONS

This study examined the influence of gamification within mobile learning environments on student engagement and knowledge retention among undergraduate learners at Tribhuvan University and its affiliated colleges in Kathmandu, Nepal. The mixed-methods findings demonstrated that incorporating gamified features—such as points, badges, leaderboards, and collaborative challenges—significantly improved both engagement and retention compared with traditional mobile learning approaches. Quantitative analysis revealed a marked rise in engagement scores (from 3.2 to 4.3 on a five-point scale) and retention rates (from 62.4% to 78.6%) among students exposed to gamified learning, with results confirmed as statistically significant ( $p < 0.001$ ). Complementing these findings, qualitative evidence highlighted that gamification reduced learning-related stress, strengthened motivation, and encouraged participation in collaborative activities. These outcomes affirm that gamification can effectively transform passive learning into an active and participatory experience. Within Nepal's diverse educational landscape—characterized by linguistic and cultural variation—such approaches offer valuable strategies for enhancing learner involvement and sustaining motivation. The findings are consistent with prior research indicating that game-based learning mechanics foster engagement, perseverance, and enjoyment in digital education environments. Furthermore, the collaborative dimension of gamified mobile learning suggests potential for cultivating supportive academic communities that encourage peer interaction and reduce disengagement in higher education.

Nevertheless, the study recognizes certain limitations, particularly the relatively brief eight-week intervention, which may not fully reflect the durability of gamification's effects over time. Future research should extend the study period to examine the long-term impact of gamified learning and investigate how localized cultural and linguistic factors influence its effectiveness in Nepal. Tailoring gamified designs to specific educational needs could further enhance the sustainability and inclusivity of mobile learning initiatives. In summary, integrating gamification into mobile learning offers a promising pathway toward more engaging, interactive, and student-centered education in Nepal. By adopting thoughtfully designed gamified systems, educators and policymakers can promote deeper learning, greater retention, and a more enjoyable academic experience. The present study adds to the growing evidence supporting gamification as a viable pedagogical innovation and highlights the importance of its continued application and adaptation within diverse global learning contexts.

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