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EVALUATING THE EFFECTIVENESS OF GAMIFIED MOBILE APPLICATIONS ON VOCABULARY ACQUISITION AND LONG-TERM RETENTION IN PRIMARY SCHOOL ENGLISH LANGUAGE LEARNERS

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Abstract:

This study investigates the pedagogical effectiveness of gamified mobile applications on English vocabulary acquisition and long-term lexical retention among primary school English as a Foreign Language (EFL) learners. Utilizing a quantitative quasi-experimental design, 60 young learners aged 9–10 years were divided into an experimental group ($n = 30$) using a gamified application featuring spaced repetition, badges, and leaderboards, and a control group ($n = 30$) receiving traditional drill-based paper vocabulary instruction over a six-week intervention period. Data collection involved a baseline pre-test, an immediate post-test to measure initial acquisition, and a delayed post-test administered four weeks post-intervention to quantify long-term memory retention. Statistically robust analyses demonstrated that while both modalities facilitated short-term lexical growth, the experimental group achieved significantly higher immediate post-test scores and maintained a resilient vocabulary retention index with a negligible decay rate compared to the control group. The findings validate the integration of structural gamification dynamics as an empirical solution to mitigate the rapid decay characterized by traditional rote-memorization models in primary language education contexts.

Keywords:

Gamification, Mobile-Assisted Language Learning (MALL), English Vocabulary Acquisition, Long-Term Retention, Primary School EFL Learners.

Introduction

Vocabulary acquisition forms the foundational architecture of foreign language proficiency and serves as an essential precursor for reading comprehension, oral fluency, and overall literacy development in young learners [4]. For primary school students operating within English as a Foreign Language (EFL) educational frameworks, the initial exposure to target lexical items frequently occurs in isolated, resource-constrained environments where natural communication avenues are structurally restricted [2]. This isolation leads to a phenomenon known as the "vocabulary gap," where low-frequency words crucial for advanced academic progression are inadequately encoded, resulting in high attrition rates shortly after initial instructional delivery [2]. Traditional pedagogical paradigms in primary institutions rely heavily on teacher-centric, explicit instruction techniques, prioritizing rote memorization, mechanical copying, and uncontextualized bilingual translation drills [1, 2]. While these conventional techniques can facilitate short-term lexical recall required for immediate testing, cognitive linguistics research indicates that they fail to

prompt deep semantic encoding, causing knowledge to decay exponentially along the traditional forgetting curve [1, 5].

To overcome these systemic constraints, modern educational systems have increasingly explored technology-enhanced paradigms, specifically Mobile-Assisted Language Learning (MALL) frameworks [3, 5]. Integrating digital mobile technologies into the instructional landscape allows for flexible, multi-modal, and continuous learning experiences that extend beyond the institutional boundaries of the physical classroom [3]. Within MALL frameworks, gamification—defined as the systematic integration of video game design elements, mechanics, and rule structures into non-game contexts—has emerged as an influential pedagogical paradigm [1, 11]. Rather than deploying fully realized educational video games, gamification superimposes structural mechanics such as point accumulation, achievement badges, leaderboards, immediate formative feedback loops, and progressive narrative leveling onto language learning tasks [1, 3, 11]. These mechanics stimulate a synergistic interaction between behavioral, affective, and cognitive axes, fostering enhanced learner agency and reducing the foreign language classroom anxiety frequently encountered by young learners [1, 11].

Despite the proliferation of gamified vocabulary software globally, the empirical landscape exhibits structural discrepancies concerning its sustainable learning value [3, 8]. Critics argue that the motivational benefits of gamified mobile software are largely driven by a transient "novelty effect," where student engagement surges during initial exposure but deteriorates rapidly as the aesthetic and structural mechanics lose novelty [1, 8]. Furthermore, multiple empirical studies have recorded instances where gamified setups produced minor or statistically non-significant differences in actual vocabulary expansion when contrasted with highly structured traditional teaching methods, suggesting that poor instructional integration can reduce applications to superficial text delivery tools [11, 12]. Crucially, while a substantial volume of existing literature emphasizes immediate lexical outcomes, rigorous investigations prioritizing delayed testing to isolate the specific impact of mobile gamification on long-term memory structures remain underrepresented [8]. Given that authentic communicative capability requires the permanent consolidation of lexical items into long-term cognitive repositories, evaluating the longitudinal trajectory of vocabulary retention is essential [8, 5]. This scientific investigation explicitly addresses these critical research gaps by quantifying the impact of a gamified mobile platform on immediate vocabulary expansion and four-week delayed retention among primary school English learners.

Methodology

This study employed a quantitative quasi-experimental research design featuring an experimental group and a non-equivalent control group. This methodology was selected to evaluate the instructional efficacy of distinct pedagogical interventions within intact, naturally occurring classroom environments, thereby preserving ecological validity while ensuring statistical rigor through identical testing parameters. The research questions guiding this inquiry were: (1) Does the integration of a gamified mobile application yield statistically significant variances in immediate English vocabulary acquisition among primary school learners compared to conventional paper-based drill instruction? (2) To what extent does a gamified mobile platform facilitate long-term vocabulary retention when evaluated through a four-week delayed post-test?

The participant pool comprised 60 primary school students drawn from two intact grade-level cohorts at an educational institution during the academic term. The sample aged between 9 and 10 years old, representing a crucial phase for developing foreign language reading and cognitive patterns [1, 2]. Class A ($n = 30$) was randomly designated as the experimental group, while Class

B ($n = 30$) served as the control group. Homogeneity in foundational English proficiency across both cohorts was confirmed using institutional academic diagnostic data. The target lexicon for the study consisted of 40 specific lexical items selected from standardized English curricula, spanning multiple semantic categories including descriptive adjectives, active verbs, and academic nouns. These target words were explicitly verified as unfamiliar to the participants during the preliminary diagnostic phase to prevent prior exposure from confounding the experimental metrics.

The educational intervention spanned a continuous six-week period. The control group engaged with the 40 target words utilizing traditional, paper-based pedagogical techniques under teacher supervision. This model involved repetitive rote spelling exercises, mechanical copying into vocabulary notebooks, reading bilingual lists, and structural memorization. Conversely, the experimental group interacted with the identical 40 vocabulary words utilizing a dedicated mobile application platform [1, 10]. The digital environment incorporated specific structural gamification elements: an absolute point reward economy for correct selections, achievement badges mapping individual milestones, public real-time leaderboards to encourage peer competition, and micro-level progressive stages [1, 11]. Crucially, the software engine incorporated automated spaced repetition algorithms, systematically presenting words at expanding chronological intervals based on user correctness to enhance neural encoding pathways [3, 5]. Both groups received identical exposure durations of 90 minutes per week, allocated across three distinct 30-minute blocks, minimizing structural variations in task time.

Data collection relied on a validated instrument based on the Vocabulary Knowledge Scale (VKS) framework, structurally adapted to measure progressive lexical familiarity from absolute unfamiliarity to productive application [8]. The identical assessment instrument was deployed across three chronological testing phases to track vocabulary evolution. The Pre-test established the initial baseline equivalence between the experimental and control cohorts. The Post-test, administered immediately following the completion of the six-week intervention, quantified immediate lexical acquisition. The Delayed Post-test, conducted exactly four weeks after the post-test without any interim review sessions, measured the scale of long-term lexical retention and decay. To verify scoring consistency across the testing instruments, two independent evaluators graded the assessments, and inter-rater reliability was verified using Cohen's kappa coefficient, which yielded a value of 0.836, demonstrating substantial consensus [8]. Quantitative statistical analysis was performed using SPSS version 26, executing paired-samples t-tests for intra-group progress and independent-samples t-tests to isolate inter-group variations, with the significance threshold established at $p < 0.05$.

Results

Statistical computations executed on the pre-test data established baseline proficiency equivalence between the two experimental tracks. The experimental group registered a baseline mean vocabulary score of 12.43 ($SD = 3.12$), while the control group achieved a mean score of 12.67 ($SD = 2.98$). An independent-samples t-test run on these scores revealed no statistically significant variation ($t(58) = -0.304$, $p = 0.762$), confirming that both learner groups possessed comparable lexical foundations prior to the launch of the treatment.

Following the completion of the six-week instructional timeline, the immediate post-test was administered to evaluate short-term acquisition. The experimental group demonstrated substantial lexical gains, with their mean score ascending to 34.57 ($SD = 3.84$), out of a maximum possible score of 40. The control group also exhibited measurable vocabulary growth, achieving a post-test mean score of 28.14 ($SD = 4.21$). To determine if the variance between these post-test outcomes was statistically significant, an independent-samples t-test was conducted. The analysis revealed a

highly significant difference favoring the gamified mobile application path ($t(58) = 6.179$, $p < 0.001$), indicating that the digital gamified environment facilitated superior immediate vocabulary expansion compared to traditional methods.

To address the central question of long-term memory consolidation, the delayed post-test was administered four weeks post-intervention. The experimental cohort demonstrated exceptional retention resilience, maintaining a high mean vocabulary score of 32.89 ($SD = 3.96$). In contrast, the control group experienced substantial attrition, with their mean score regressing to 20.45 ($SD = 4.88$). An independent-samples t-test applied to these longitudinal retention metrics confirmed a wide and statistically significant divergence between the groups ($t(58) = 10.816$, $p < 0.001$). This confirms that the gamified mobile application framework exerted a powerful influence on sustaining vocabulary knowledge over extended non-instructional intervals. Table 1 summarizes the descriptive statistical outcomes across all three testing periods.

Table 1. Vocabulary Performance Metrics Across Testing Phases

Group Name	Sample Size (n)	Pre-test Mean (SD)	Immediate Post-test Mean (SD)	Delayed Post-test Mean (SD)
Experimental (Gamified App)	30	12.43 (3.12)	34.57 (3.84)	32.89 (3.96)
Control (Traditional Paper)	30	12.67 (2.98)	28.14 (4.21)	20.45 (4.88)

Intra-group evaluation using paired-samples t-tests highlighted the distinct internal dynamics of each instructional environment. For the experimental group, the transition from the immediate post-test to the delayed post-test resulted in a marginal, non-significant score reduction of 1.68 points ($t(29) = 1.984$, $p = 0.057$), indicating successful lexical stabilization. Conversely, the control group experienced a statistically significant drop of 7.69 points between the post-test and delayed post-test phases ($t(29) = 8.412$, $p < 0.001$). This pattern indicates that while paper drills supported immediate recall, they were vulnerable to rapid forgetting over time.

Analysis and Discussion

The statistical findings supply robust empirical validation for the integration of gamified mobile applications within primary EFL vocabulary curricula. The data clearly demonstrates that while both traditional instruction and gamified intervention generate immediate lexical expansion, the gamified mobile architecture yields structurally superior short-term acquisition and long-term retention. The significant immediate post-test outperformance of the experimental group ($\text{Mean} = 34.57$) relative to the control group ($\text{Mean} = 28.14$) can be analyzed through the lens of cognitive load and multi-modal interaction theories [5, 11]. Traditional paper drill formats typically require low-level passive processing where learners execute superficial phonetic or graphic repetitions without deeper semantic anchoring [1, 2]. This often leads to cognitive fatigue, reducing the student's operational working memory capacity during lexical encoding [1, 5]. In contrast, the gamified mobile application presents words through multi-sensory formats—combining visual graphics, audio pronunciation cues, and interactive game tasks—which spreads cognitive processing across dual auditory and visual sub-channels, optimizing immediate retention [3, 5].

The most compelling outcome of this study concerns the stark divergence in vocabulary maintenance observed during the four-week delayed post-test. The control group's score deteriorated by 27.3% relative to their post-test achievement, illustrating the standard forgetting curve common to rote memorization methods [1, 5]. Conversely, the experimental group experienced a minimal, statistically non-significant decay of only 4.8%, preserving the vast majority of their acquired vocabulary. This high retention stability can be attributed to the automated spaced repetition systems embedded within the mobile application's architecture [3, 5]. Spaced repetition actively counteracts natural memory decay by scheduling word reviews at scientifically calculated intervals, forcing active memory retrieval just as an item is about to be forgotten [3, 5]. For young learners, this active retrieval requirement strengthens neural pathways and transforms fragile working memory traces into durable structures within long-term cognitive repositories [5].

Psychologically, the superior learning outcomes achieved by the experimental group are tied to the structural gamification mechanics built into the digital application [1, 11]. Elements such as instant point feedback and achievement badges leverage intrinsic and extrinsic motivational pathways, fulfilling the core psychological needs of competence and autonomy [1, 11]. The real-time leaderboard component introduces an engaging element of peer competition that encourages sustained interaction with the learning material over the six-week timeline [1, 11]. This continuous, high-quality engagement effectively mitigates the "wear-out" or novelty effect often cited by gamification critics [1, 8]. By maintaining low-anxiety, highly immersive learning conditions, the application helps young learners build independent vocabulary review habits, ensuring resilient long-term retention [1, 3, 11]. These results indicate that when gamification mechanics are systematically aligned with sound cognitive principles, they represent a highly effective alternative to traditional rote-learning frameworks in primary language education.

Conclusion

This scientific investigation confirms that gamified mobile applications are highly effective tools for enhancing English vocabulary acquisition and long-term retention among primary school EFL learners. The empirical findings reveal that while traditional paper-based memorization drills can support short-term word recall, they are highly vulnerable to rapid memory decay, as evidenced by a substantial 27.3% score drop over a four-week non-instructional interval. In contrast, integrating structural gamification elements—such as point reward systems, progressive leveling, immediate formative feedback, and automated spaced repetition algorithms—significantly improves initial lexical encoding and ensures excellent memory stability, restricting vocabulary decay to a minimal 4.8%. These results indicate that mobile-assisted gamification effectively transforms vocabulary acquisition from a passive, high-anxiety task into an active, low-stress, and cognitively deep learning experience. Consequently, it is recommended that primary school language educators systematically integrate gamified mobile tools into formal curricula as an empirical alternative to traditional rote-learning models. Future research should explore larger, diverse student cohorts over extended longitudinal periods to assess the long-term impacts of gamified applications across diverse language domains.

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