

## The Effect of Digital Gamification on Iranian EFL Learners' Vocabulary Development, Self-Regulated Learning, and Engagement

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Research Paper

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**Abstract:** While vocabulary development, Self-Regulated Learning (SRL), and Learner Engagement (LE) are all critical dimensions of effective English as a Foreign Language (EFL) education, conventional instruction in Iranian classrooms often lacks the required tools to foster deep and lasting development in these areas. This study explored the influence of digital gamification on Iranian EFL learners' development of vocabulary knowledge, SRL, and LE. One hundred fifty participants, aged 14 to 20, were selected from an initial pool of 200 using the Oxford Quick Placement Test (OQPT). The instruments used to gather data included the OQPT, a teacher-made vocabulary test, and adapted versions of SRL and LE questionnaires. Based on the OQPT scores, two cohorts of participants were delineated: an experimental and a control group. The experimental group participated in a digitally mediated program incorporating points, badges, leaderboards, and interactive digital tasks, while the control group received conventional instruction. The findings demonstrated notable improvements in learners' vocabulary scores (Cohen's  $d=-0.740$ ) and engagement levels (Cohen's  $d=-1.437$ ) in the experimental group. However, statistical testing demonstrated that learners' SRL scores remained comparable across the two conditions. Implications of these findings extend to EFL teachers, particularly in the design of vocabulary and engagement-focused interventions, instructional designers, and policymakers aiming to modernize language instruction and boost learner motivation and autonomy through gamified environments.

**Keywords:** Digital Gamification, Game-Based Learning, Learner Engagement, Self-Regulated Learning, Vocabulary Development

### Introduction

Over the past decade, rapid technological advances and the widespread availability of digital tools have catalyzed transformative changes in educational practices. With traditional non-digital games establishing a successful track record in classroom contexts, educators have begun to develop digital strategies that incorporate similar interactive principles. One particularly promising innovation is digital gamification. Digital gamification can be delineated as the deliberate incorporation of gamification mechanisms—such as scoring metrics, achievement insignias, ranking systems, adaptive tasks, narrative simulations, and multimodal evaluative responses—integrated into non-game instructional environments to support learning (Deterding et al., 2011; Hamari et al., 2014). A complete account of this evolution depends on the ability to distinguish between two related but different concepts in educational technology: Game-Based Learning (GBL) and gamification. GBL is concerned with the utilization of entire, fully designed games that integrate teaching directly into the gameplay experience (Plass et al., 2015). Unlike GBL, gamification aims to improve motivation and engagement without including extensive gaming experiences in the learning process (Deterding et al., 2011). This progression from traditional play to digital platforms demonstrates the sustained relevance of

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game-mediated instruction and its correspondence with modern technological developments. Digital gamification, grounded in both the legacy of early childhood play and the established merits of non-digital game-based learning, offers a transformative pedagogical alternative. By integrating adaptive and interactive game modules into vocabulary instruction and other language skills, educators can transform routine tasks into engaging, dynamic experiences that stimulate intrinsic motivation (Deci & Ryan, 2000) and promote self-monitoring of progress (Zimmerman, 2000; Zimmerman & Schunk, 2011). Empirical studies indicate that these game-based interventions can significantly enhance vocabulary retention and foster a more robust cognitive and affective engagement (Reinders & Wattana, 2014).

Self-Regulated Learning (SRL) encompasses the active process of taking charge of one's learning by planning, monitoring, and reflecting on one's experiences (Zimmerman, 2000; Zimmerman & Schunk, 2011). This type of learning is especially important in English as a Foreign Language (EFL) contexts, where learners face unique challenges like language barriers, cultural differences, and different levels of exposure to the target language. These factors require a proactive and self-directed approach. Students must navigate complex linguistic rules and cultural details while managing their progress on their own. Digital gamified platforms may provide the scene for building and improving SRL in EFL settings. These platforms use a variety of interactive features, including progress dashboards that show achievements visually, immediate feedback tools that give real-time insights into performance, adaptive difficulty adjustments that match learners' abilities, and goal-tracking systems that help set and monitor personal learning goals. By combining these tools, gamified systems can create engaging and supportive learning spaces. They can empower learners to spot areas for improvement, take charge of their own educational paths, and encourage greater independence and internal motivation. (Li et al., 2022).

Furthermore, Bandura's (1986) Social Cognitive Theory (SCT) proposes that learning should be regarded as a social process, profoundly shaped by an individual's observation of and interaction with others in their environment. Digital technology has broadened the uses of SCT, especially in education through gamification. Gamification incorporates community-driven challenges, dynamic leaderboards, and interactive forums to boost social learning. These tools facilitate learners' awareness of peer performance, support comparative self-assessment, and promote strategic adjustments informed by social feedback (Chen & Tu, 2021). In addition to the social aspects of learning, effective educational practices must focus on the emotional and cognitive parts of Learner Engagement (LE). The framework proposed by Fredricks et al. (2004) demonstrates that successful learning integrates three overlapping dimensions—performance-related, affective, and intellectual. Digital gamified environments are especially good at addressing all three dimensions at once. For example, they encourage learners to engage behaviorally through structured challenges and rewards. They promote emotional investment through competition and collaboration. They also require cognitive effort as learners strategize, analyze, and solve complex problems. This well-rounded approach keeps learners fully engaged, motivated, and mentally stimulated throughout their educational experience.

In the Iranian educational context, particularly with regard to instructional approaches to teaching EFL, digital gamification presents a vital opportunity for addressing the limitations of conventional teaching methodologies. Historically, Iranian EFL classrooms have relied heavily on teacher-centered methods and rote memorization, which, while effective for basic vocabulary accumulation (Nation, 2001; Schmitt & Schmitt, 2020), often result in superficial learning outcomes and insufficient practical application in authentic communicative contexts. More importantly, traditional instructional methods fall short in fostering essential SRL skills—such as metacognitive monitoring and goal setting—that are indispensable to autonomous language development. (Ortega, 2014). This clear impetus for change necessitates exploring innovative methods that enhance both engagement and deep, self-directed learning. Although research has extensively examined gamification and game-based learning globally (Gee, 2003; Kapp, 2012), most studies focus narrowly on either digital games or gamified tasks, often overlooking the specific cognitive and educational effects on learners. The gap becomes especially salient in the Iranian EFL settings, where conventional vocabulary teaching remains dominant (Pishghadam & Sabouri, 2011). Despite a global trend toward digital

gamification, its real-world implementation and comprehensive effects—especially on vocabulary development, SRL, and LE—have not been studied in depth among students engaged in EFL instruction within the Iranian setting. Therefore, this line of research probes the influence of digitally gamified activities on the development of vocabulary knowledge, SRL, and LE of individuals undertaking EFL studies in Iran. By integrating cognitive, metacognitive, and emotional dimensions, this study aims to offer an empirical account of how digital gamification can reshape language instruction and foster deeper, autonomous learning within a context still largely governed by traditional methods.

## Literature Review

### Gamification and Vocabulary Development

The rise of digital gamification has changed how vocabulary instruction works, introducing a range of innovative strategies to improve learning and retention. This new approach combines different learning theories that have long supported teaching methods and brings them into modern classrooms where detailed game mechanics improve student engagement, boost intrinsic motivation, and maintain cognitive effort. Studies reveal that gamification, operationalized as the integration of game-based mechanics and principles into non-game environments, provides substantial benefits for vocabulary development. Cancino and Viguera (2024) examined the influence of a game-oriented instructional method, implemented through Kahoot! within the domain of vocabulary knowledge development and vocabulary-related self-efficacy among primary learners enrolled in English language courses in Chile. Their results suggested that although both the trial and the standard group achieved comparable improvements in vocabulary learning, the trial group exhibited a statistically notable enhancement in self-efficacy concerning vocabulary. This study underscores the pedagogical value of gamified strategies in EFL contexts, suggesting that such approaches can foster greater learner engagement and strengthen students' confidence in their language learning trajectories.

The educational value of a game-structured environment for instructing English vocabulary in university and college contexts was examined in a quasi-experimental study by Panmei and Waluyo (2022). The research specifically looked at how the Quizizz application affected learning outcomes and student independence. This study started to tackle issues like the limited class time EFL students have to pick up important vocabulary and the lack of research on using applications employing gamification strategies for the purpose of supporting vocabulary learning in out-of-class contexts. The results showed no significant distinctions in overall vocabulary scores and student independence between the two groups.

Rababah et al. (2025) examined the role of gamified learning in boosting motivation and vocabulary development among 60 Jordanian middle-aged English learners with pre-intermediate English proficiency levels. Over a period of six weeks, the control group went through a conventional vocabulary learning process, whereas the experimental group engaged in interactive games, quizzes, and competitions that were designed to strengthen engagement and advance learners' educational attainment. The gamification tools covered online games, flashcards, and word challenges for learning vocabulary. The results indicated that gamification showed considerable enhancement in vocabulary learning and retention within the manipulated group compared to the baseline group, showcasing the potential of gamification to enrich language learning with the aim of enhancing motivational levels in Jordanian middle-aged EFL learners. These findings contribute to the understanding of effective educational strategies tailored to middle-aged learners and underline the necessity for innovative pedagogical practices in the region.

In a modern educational setting, Pratiwi et al. (2024) compared the effectiveness of the digital prowess of gamified technology against the time-honored reliability of traditional paper-based methods within a flipped classroom setting in an Indonesian university context. They conducted a mixed-methods research design to compare the effectiveness of conventional paper-based method and gamified technology in boosting vocabulary skills of students with high and low language proficiency

levels. Paper-based materials were used in the control group, while Quizlet, Kahoot!, Quizizz, Socrative, and Google Form were deployed in the experimental groups. A pre- and post-test were used for gathering the quantitative data, while teachers' guided reflections were utilized for collecting the qualitative data. The analysis of the quantitative data showed that the conventional paper-based format proved to be more advantageous in facilitating vocabulary learning of both high and low proficiency level learners. However, the qualitative data reflecting teachers' beliefs revealed that the gamified technology was more beneficial for high proficiency learners, whereas low proficiency learners benefited more from the paper-based method. When viewed together, the contradictory findings of Rababah et al. (2025) and Pratiwi et al. (2024) can be ascribed to the fact that the effectiveness of gamified vocabulary instruction is highly dependent on learner characteristics, instructional context, and the nature of the gamification tools that are used in the process. Rababah et al.'s findings can be discussed in the light of the motivational affordances of gamified activities for middle-aged, pre-intermediate EFL learners, for whom engagement and affective factors play a critical role in sustaining vocabulary learning. In contrast, Pratiwi et al.'s results indicate that in a university-level flipped classroom, structured paper-based materials may provide clearer scaffolding and reduced cognitive load, thereby facilitating more effective vocabulary learning. Moreover, the reliance on digital platforms such as Quizlet may have emphasized surface-level recognition rather than deeper lexical processing, potentially limiting gains for both low and high proficiency learners. These discrepancies underscore the need for a more nuanced examination of how proficiency level, learner age, and pedagogical design mediate the effect of gamification on learners' vocabulary development.

Haoming and Wei (2024) conducted a systematic review on gamification in Augmented Reality (AR) and Virtual Reality (VR) contexts. This research filled a gap in the literature since few reviews have specifically analyzed the use of gamified AR or VR to improve language skills, especially vocabulary. They selected 23 scholarly articles for the final analysis from an initial pool of 97 studies, using clear inclusion criteria and a literature selection process established by the selected reporting items for systematic reviews and meta-analyses frames. Their methodology included a literature search in the Web of Science Core Collection, followed by a three-phase screening process to ensure the inclusion of studies meeting specific eligibility criteria. These criteria required the studies to be written in English, peer-reviewed, based on empirical research, and focused on improving vocabulary knowledge through gamified AR or VR. The two researchers extracted relevant data and cross-checked it, reaching a coding consensus through detailed discussions. The review found that gamified AR/VR-supported vocabulary development mainly targeted word form and meaning, with intentional learning as the primary approach. Besides, researchers often used the vocabulary tests developed by themselves to assess learning, including translation tasks, multiple-choice evaluations, and word-pairing exercises. They identified interactivity to be a crucial benefit of both AR and VR gamification. It offers important insights into how to use gamified AR and VR effectively for vocabulary learning, pointing out areas demanding further investigation.

However, research conducted in Asia (Lee & Baek, 2023) shows the importance of culturally adapted gamification in supporting vocabulary learning. Such methods facilitate the acquisition and learning of new vocabulary while simultaneously enhancing learners' ability to employ words appropriately in context, thereby contributing to improved language fluency.

### **Gamification and Self-Regulated Learning**

Self-regulated learning, as a multifaceted concept, encompasses those strategies and processes that learners employ to establish meaningful learning goals, observe their growth towards these goals, and effectively manage their learning activities. The SRL framework has been extensively developed in the works of Zimmerman (2000) and Zimmerman and Schunk (2011), who stress the significance of learner agency in promoting autonomy and success within educational environments. SRL highlights the active participation of students in designing and managing their educational journeys, emphasizing the need for intentional and reflective practices that foster their development as autonomous learners. In the specific setting of EFL, the cultivation of SRL skills becomes particularly critical as learners navigate the inherent complexities of acquiring a new language. According to Dörnyei (2005) and Oxford (2017),

these skills serve a dual function within the language learning process, which means that they not only help learners overcome challenges such as linguistic and cultural barriers but also trigger greater overall effectiveness in language learning practices by fostering strategic learning behaviors and self-motivation that are essential for long-term success.

To examine the influence of gamification on learners' SRL, Li et al. (2022) performed an empirical study on participants comprising primary students undertaking formal schooling in an ESL context. The study was structured as a quasi-experiment, extending over the period of one semester, during which students engaged with a game-enhanced virtual learning framework called Oxford Achiever as an extracurricular source. Data were collected through reading tests, questionnaires assessing SRL, system usage metrics, and semi-structured interviews. Results suggested that learners who interacted with the gamified system more frequently showed a significant improvement in their reading performance. Moreover, those with initially lower interests in SRL and self-efficacy demonstrated notable gains, suggesting that gamification can be particularly beneficial for learners with weaker self-regulatory skills. The qualitative findings indicated that gamification enhanced students' motivation and helped them develop SRL strategies, such as progress monitoring.

The effect of virtual game-based learning environments on the promotion of SRL skills in foreign language learners was studied by Cortes and Carreño-Bolivar (2024). The virtual learning environment of this study followed Zimmerman's (2000) SRL framework. The study included game-inspired instructional features designed to engage young learners and support their self-regulation processes. The results indicated a significant enhancement in learners' practice of SRL techniques, especially in setting goals, observing progress, and reflecting on their educational outcomes. This research found that game-enhanced virtual frameworks can successfully enhance SRL abilities in young students undertaking second language learning by promoting motivation and engagement. Nonetheless, it also emphasized that gamified resources should be combined with direct instruction in SRL techniques to optimize self-regulation outcomes. Participants rated the usability of the gamified tool positively, indicating that the design resonated well with them.

The influence of Digital Platform-Based Gamification (DPBG) on SRL skills was studied by Alhalafawy and Zaki (2022) during the COVID-19 pandemic. The analysis confirmed statistically considerable gains in learners' SRL skills, suggesting that gamification contributes to the development of competencies in defining goals, organizing plans, monitoring progress, memorizing content, and engaging in social assistance, highlighting specific ways it supports self-regulated learning. In a more recent investigation, Slamet and Basthomi (2024) examined how gamification affected key aspects of EFL undergraduates' Self-Directed Learning (SDL), self-management, willingness to learn, and self-control. The findings indicated that gamification initially enhanced student engagement and motivation. However, challenges regarding self-management and self-control emerged over time. The participants reported positive outcomes in goal setting and motivation, yet they encountered variability and difficulties in task prioritization, efficient resource utilization, and maintaining consistent self-control. These issues suggest that the advantages of gamification may not be uniformly applicable across all aspects of SDL. The results emphasize the need for a more detailed approach to integrating gamification in education.

Building on the growing body of research in educational technology, a recent investigation carried out in the Iranian context by Namaziandost et al. (2025) probed the comparative role of gamification and ludicization in EFL learners' Ambiguity Tolerance (AT), Learning Adaptability (LA), and self-management, as well as overall Learning Outcomes (LOs). This study was driven by increased interest in incorporating game mechanics and the creation of ludicization within the field of language learning to raise learner engagement and improve learning results. The results showed notable improvements in AT, LA, self-management, and LOs in both the gamification and ludicization groups when compared with the control group. The literature on gamification and SRL suggests that through integrating focused self-regulation practices with interactive, tech-based platforms, teachers can create richer learning environments to help students manage and regulate their own learning and encourage more autonomy and involvement.

## Gamification and Learner Engagement

In response to growing concerns about disengagement in EFL contexts—particularly in settings characterized by conventional instruction—digital gamification is recognized as a pedagogical strategy that modernizes educational environments by fostering learner-centered, interactive, and motivating practices. This review synthesizes empirical studies that collectively inform the investigation of digital gamification's influence on EFL/ESL learners' engagement.

Numerous quasi-experimental and mixed-methods studies on the implementation of gamification tools in foreign language learning contexts consistently report enhanced learner engagement. Tsai (2024), for instance, examined Taiwanese undergraduates' engagement using a Moodle-based gamified system involving badges, experience points, and leaderboards. The experimental group showed substantially greater improvements in motivation and participation, particularly in online discussion forums and quizzes. Similarly, Aeni et al. (2024) conducted an exploratory study with 78 Indonesian EFL students using the Bamboozle platform. Their findings indicated that most participants experienced increased engagement and collaboration.

Evidence from Latin America further affirms these trends. Esquivel Vera et al. (2021) carried out a research in Paraguay to compare the contribution of gamification and GBL on EFL learners' motivation and engagement. Twenty-eight adolescents (A2–B1 CEFR) participated in a course where gamification was applied throughout using ClassDojo and Coup-inspired systems, while GBL was implemented for selected activities. Data collected from surveys, interviews, and observations suggested that while both approaches increased learners' motivation and enjoyment, gamification resulted in greater sustained engagement due to ongoing challenges, feedback, and control for learners. This was mirrored in Pakistan by Safdar et al. (2024), who investigated conventional, gamified, AI-driven instruction among 120 undergraduates. The AI-assisted group demonstrated the highest proficiency gains (27.4%) and engagement, highlighting the added benefits of personalized feedback and adaptive learning pathways. However, the study raised concerns about reduced human interaction in AI-driven instruction. Taken together, these studies offer robust evidence that digital gamification, when intentionally designed and supported by teacher facilitation, can significantly enhance behavioral, cognitive, and emotional engagement in EFL contexts. It seems that for Iranian EFL learners—who often encounter rigid, grammar-focused instruction—such approaches can offer opportunities to foster deeper involvement, intrinsic motivation, and sustained learning outcomes.

Despite the strong international evidence, significant gaps remain—particularly concerning Iranian EFL learners. First, there is limited contextual focus; although many studies have examined gamification globally, few have specifically addressed the unique cultural and pedagogical dynamics in Iran. This gap raises questions about the extent to which internationally derived observations can be directly applied to Iranian learners. Second, while vocabulary development is critical in language learning, its intersection with digital gamification has been underexplored within this demographic. Prior studies have broadly addressed language outcomes, often neglecting the specific nuances of vocabulary development. Third, the mechanisms underpinning SRL in gamified environments remain insufficiently understood, especially given Iran's educational emphasis on teacher-directed instruction. Additionally, the measurement of learner engagement has typically relied on broad definitions, failing to capture the distinct cognitive, emotional, and behavioral dimensions relevant to Iranian contexts. Finally, most existing studies focus on short-term outcomes; the longevity or sustainability of gamification's benefits over time—especially regarding vocabulary development, SRL, and engagement—remains largely unexplored. The objectives underpinning the present study prompted the researchers to pose the following research questions:

**Research Question One:** Does digital gamification have any significant effect on Iranian EFL learners' vocabulary development?

**Research Question Two:** Does digital gamification have any significant effect on Iranian EFL learners' self-regulated learning?

**Research Question Three:** Does digital gamification have any significant effect on Iranian EFL learners' engagement?

## Methodology

### Participants

Initially, 200 individuals were invited to take part in the study. They were between the ages of 14 and 20 and had different levels of language proficiency. Recruitment was carried out using a convenience sampling technique while addressing practical issues. They had to fall within the intermediate and upper-intermediate level of proficiency as determined by the Oxford Quick Placement Test (OQPT) and have at least EFL learning experience of two years. Only those who gave informed consent and showed willingness to participate in digital gamification activities, and had reliable access to the required technology, like a computer or smartphone, were included in the study. To create a uniform group, the OQPT was administered to these 200 participants, and a final sample of 150 who met the criteria was chosen for the study.

### Instruments

#### *The Oxford Quick Placement Test*

The OQPT version 1 was utilized as a key tool for the accurate grouping of participants. This computer-adaptive test, which is grounded in the CEFR framework, measures both vocabulary knowledge and writing skills and provides a complete evaluation of English language abilities. Its robust design, which is both reliable and valid, enabled the quick sorting of learners into similar proficiency levels. Those participants who scored between 41 and 60 were classified as Intermediate, and those with scores from 61 to 80 were identified as Upper-Intermediate. This clear distinction of proficiency levels enhanced the internal validity of the study. It also helped to maintain balanced group assignments in the quasi-experimental setup and controlled for initial differences in language skills.

#### *Teacher-Made Vocabulary Development Test*

To determine participants' command of vocabulary, a teacher-made multiple-choice test was administered both as a pre-test, preceding the intervention, and a post-test, immediately after the treatment. The test comprised 20 items that matched the English Vocabulary in Use (2017) textbook. They aimed to reflect the teaching goals and target vocabulary of the program, ensuring the content was relevant and valid. Before starting, the internal consistency of the test was checked by calculating Cronbach's alpha. This resulted in a reliability index of  $\alpha = 0.83$ . Furthermore, to ensure the content validity of the teacher-made test, it was reviewed by three experienced EFL teachers. They confirmed that the content of the test was appropriate for measuring the vocabulary knowledge of the learners and in alignment with learning objectives. Each correct response was awarded one point, while incorrect responses received a score of zero.

#### *Adapted Learner Engagement Questionnaire*

An adapted version of the engagement questionnaire created by Abbasi et al. (2024) was utilized to assess participants' engagement levels. The original instrument includes 54 items, but it was modified to better fit the specific goals and context of this study, resulting in a 48-item version. The adapted questionnaire revealed satisfactory internal consistency reliability, with a reliability coefficient of  $\alpha = 0.79$ , confirming its suitability for evaluating EFL learners' engagement in digitally gamified learning environments.

### *Adapted Self-Regulated Learning Questionnaire*

This instrument is an adapted form of the original SRL Questionnaire for EFL contexts, created by Salehi and Jafari (2015). The questionnaire covers important areas like intrinsic motivation, self-efficacy, locus of control, and a set of metacognitive and behavioral strategies, including planning, self-monitoring, and self-evaluation. It provides a solid measure of SRL in gamified settings. The pilot administration of the questionnaire revealed strong internal consistency, with a Cronbach's alpha of 0.85. The final version utilized in this investigation achieved a Cronbach's alpha of 0.74, showing an acceptable level of reliability.

### **Data Collection Procedures**

A 12-week pre-test/post-test randomized controlled trial was conducted with 150 EFL learners at Intermediate to Upper-Intermediate proficiency levels to examine the effects of a digitally gamified instructional model on vocabulary knowledge, SRL, and learner engagement. Based on OQPT results, the participants were randomly assigned to either a control group receiving the conventional, teacher-led instruction grounded in Communicative Language Teaching (CLT) or an experimental group receiving gamified instruction across 36 sessions.

The experimental group participated in a gamified instructional model delivered across 36 sessions (three sessions per week), with each session incorporating a structured 30-minute gamified activity aligned with the weekly vocabulary syllabus and the teaching materials. Gamification elements were systematically embedded into curriculum-based tasks rather than used as stand-alone activities. Specifically, real-time quizzes delivered via Quizizz! were employed at the end of each instructional unit to reinforce target lexical items through multiple-choice, contextualized sentence completion, and synonym-matching tasks. Quizlet Live was used twice weekly for collaborative flashcard-based competitions that emphasized form-meaning connections and rapid lexical retrieval. In addition, Virtual Escape Room activities were implemented biweekly, requiring learners to solve vocabulary-based puzzles and contextual clues in sequence to complete thematic challenges related to the instructional content.

Gamification mechanics were operationalized through a transparent incentive system. Points were awarded based on task accuracy, completion time, and collaborative contribution during group activities. Weekly leaderboards displayed cumulative group scores to foster sustained competition, while digital badges were granted for specific achievements such as vocabulary mastery, consistent participation, or strategic teamwork. Furthermore, group composition was randomly reshuffled every two weeks to minimize fixed-ability grouping effects and promote equitable participation. By systematically comparing gains in vocabulary knowledge, engagement, and SRL between the conventionally instructed control group and the digitally gamified experimental group, the study aimed to isolate and evaluate the pedagogical efficacy and instructional fidelity of the gamified learning model.

### **Results**

This section details the statistical methodology employed to answer the research questions regarding the intervention's effectiveness on EFL learners' vocabulary development, SRL, and learner engagement. To verify the assumption of normality needed for parametric tests, the Shapiro-Wilk test was run for each set of scores. The p-values for all groups and conditions exceeded the 0.05 significance threshold, suggesting that the distributions conformed adequately to normality, thereby justifying the use of parametric tests.

#### **Research Question One**

To determine if digital gamification could significantly affect learners' vocabulary development, an independent-samples t-test was used to compare the vocabulary scores of both groups at pre- and post-intervention phases.

**Baseline Comparison of Pre-Test Scores**

As the first step, an independent-samples t-test was carried out to ensure that no notable differences existed between the groups in terms of their vocabulary knowledge before the intervention. The outcomes are reported in Table 1.

**Table 1**

*Independent-Samples T-Test Results for Pre-Test Vocabulary Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference
Pre-test	Equal variances assumed	.427	.514	-1.470	148	.144	-.600	.408
	Equal variances not assumed			-1.470	147.561	.144	-.600	.408

As Table 1 presents, Levene's test for equality of variances yielded a non-significant result ( $F= 0.427$ ,  $p= .514$ ), indicating the homogeneity of variance. In other words, the analysis revealed that mean pre-test scores were statistically comparable between the groups,  $t(148) = -1.470$ ,  $p= .144$ . This lack of significance suggests that the two groups were statistically equivalent at baseline and ensures that any differences observed after the treatment can be ascribed to the instructional procedure rather than to existing imbalances.

**Post-Test Comparison Between Groups**

To inspect the possible effect of digital gamification on Iranian EFL learners' vocabulary development, the post-test scores of the control and experimental groups were compared using an independent-samples t-test. The findings are summarized in Table 2.

**Table 2**

*Independent-Samples T-Test Results for Post-Test Vocabulary Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2- tailed)	Mean Difference	Std. Error Difference
Post-test	Equal variances assumed	2.921	.090	-4.530	148	.000	-1.573	.347
	Equal variances not assumed			-4.530	139.182	.000	-1.573	.347

As shown in Table 2, variance equality was confirmed by Levene's test, which produced a non-significant outcome ( $F= 2.921$ ,  $p= .090$ ), indicating homogeneity of variance and allowing for the interpretation of the t-test results. The analysis revealed a meaningful difference in post-test scores,  $t(148) = -4.530$ ,  $p < .001$ , with the experimental group surpassing the control group in performance. To evaluate the practical magnitude of this difference, Cohen's  $d$  was calculated. A Cohen's  $d$  of  $-0.740$  showed a large effect. This indicates that the instructional intervention significantly affected learners' performance. The related measures of Hedges' correction ( $-0.736$ ) and Glass's delta ( $-0.855$ ) reinforce

this conclusion. The strong effect size emphasizes the teaching value of the intervention in vocabulary instruction.

### Research Question Two

To determine if digital gamification could significantly affect learners' SRL, an independent-samples t-test was utilized to evaluate differences between the SRL scores of both groups at pre- and post-intervention phases.

#### *Baseline Comparison of SRL Pre-Intervention Scores*

To assess baseline equivalence, an independent-samples t-test was executed to determine differences in SRL scores between the groups before the intervention. The outcomes of this analysis are demonstrated in Table 3.

**Table 3**

*Independent-Samples T-Test Results for SRL Pre-Intervention Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SRL pre-scores	Equal variances assumed	.624	.431	-.968	148	.335	-.123	.127
	Equal variances not assumed			-.968	147.037	.335	-.123	.127

Based on Table 3, the equality of variances was supported, as Levene's test did not reach statistical significance ( $F = 0.624$ ,  $p = 0.431$ ). Pre-intervention SRL scores of the two groups did not differ significantly, as evident in t-test results,  $t(148) = -0.968$ ,  $p = 0.335$ . This finding indicates that the groups were homogeneous in terms of SRL at the outset of the study.

#### *Post-Intervention Comparison of SRL Scores*

After the intervention, a further independent-samples t-test was undertaken to evaluate whether the intervention had any significant effect on learners' SRL scores. Analysis results are displayed in Table 4.

**Table 4**

*Independent-Samples T-Test Results for SRL Post-Intervention Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
SRL post-scores	Equal variances assumed	5.090	.026	-.816	148	.416	-.106	.130
	Equal variances not assumed			-.816	138.131	.416	-.106	.130

In light of the evidence reported in Table 4, the intervention did not have a statistically significant effect. Levene's test for variance equality was significant ( $p = 0.026$ ), meaning the variances of the two groups were not equal, so the row for "Equal variances not assumed" was used for the final analysis. T

(138.131) = -.816 and  $p=0.416$  revealed a non-significant result. In short, the reported differences were likely due to random chance rather than the intervention itself.

### Research Question three

This section presents the analysis of the intervention's effect on learner engagement.

#### *Baseline Comparison of Engagement Pre-Intervention Scores*

After confirming that the data adhered to the assumption of normal distribution, an independent-samples t-test (Table 5) was conducted to determine if a meaningful difference existed in baseline engagement scores of the control and experimental groups.

**Table 5**

*Independent-Samples T-Test Results for Engagement Pre-Intervention Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Engagement Pre-intervention Scores	Equal variances assumed	3.394	.067	.680	148	.497	.106	.155
	Equal variances not assumed			.680	144.996	.497	.106	.155

According to the independent-samples t-test outcomes displayed in Table 5, baseline engagement scores were comparable between the groups, with no significant differences detected. A non-significant outcome from Levene's test confirmed comparable variances between the groups ( $F=3.394$ ,  $p=0.067$ ), allowing for the assumption of equal variances.  $T(148)=0.680$  and  $p=0.497$  revealed a non-significant result. This finding indicates that the groups were equivalent at the beginning of the study, confirming the absence of any significant baseline differences in engagement that could confound the intervention's effects.

#### *Post-Intervention Comparison of Engagement Scores*

An independent-samples t-test was run to determine whether the intervention had any significant effect on learners' engagement scores. Table 6 reports the results obtained from the analysis.

**Table 6**

*Independent-Samples T-Test Results for Engagement Post-Intervention Scores*

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Engagement Post-intervention Scores	Equal variances assumed	1.226	.270	-8.800	148	.000	-.588	.066
	Equal variances not assumed			-8.800	142.684	.000	-.588	.066

According to Table 6, the independent-samples t-test demonstrated a significant effect of the intervention on post-test engagement scores. Levene's test testified the equal variances ( $p=0.270$ ). The

t-test results showed a remarkable difference between the groups,  $t(148) = -8.800$ ,  $p < .001$ . With a mean difference of  $-0.588$ , this finding confirms that the gamified group's average engagement score was significantly higher than the control group, proving that gamification successfully increased learner engagement. Following the significant t-test result, effect size analysis was conducted to gauge the magnitude of the difference in post-intervention engagement scores. The analysis revealed a large and significant effect, with all metrics—Cohen's  $d$  ( $-1.437$ ), Hedges' correction ( $-1.430$ ), and Glass's delta ( $-1.600$ )—consistently confirming a substantial difference where mean engagement scores were significantly greater in the experimental group than in the control group.

### Discussion

In addressing the first research question of this study, the results showed that digital gamification significantly improved vocabulary development among Iranian EFL learners. These findings relate to Cognitive Load Theory (Sweller, 1988), which indicates that well-structured gamified tasks reduce unnecessary processing and improve the efficiency of working memory during learning. Similarly, Constructivist Learning Theory (Piaget, 1952) supports the idea that learners build knowledge more effectively through active involvement, which gamification naturally encourages. Digital Game-Based Learning Theory (Prensky, 2001) further supports the idea that engaging, game-like experiences boost learner motivation, attention, and recall.

These findings are reinforced by prior research. For example, Rababah et al. (2025) reported notable disparities between the experimental and control groups, using interactive games, quizzes, and competitions. Genç Ersoy and Belet Boyacı (2021) examined the influence of gamification in Turkish vocabulary teaching on vocabulary development and learner motivation in fourth-grade students and reported that gamification-based vocabulary teaching improved vocabulary learning and engagement. However, the findings are not in line with Cancino and Viguera (2024), Panmei and Waluyo (2022), and Pratiwi et al. (2024), who pointed out the non-significant effect of gamification on learners' vocabulary development. Panmei and Waluyo (2022) warn about the risk of cognitive overload, especially for lower-proficiency learners, when game complexity does not match learner readiness. Nah et al. (2014) and Panmei and Waluyo (2022) also raised concerns that gamification might promote reward-driven behavior instead of deep learning. These findings highlight the need to match gamification design with learner proficiency, task complexity, and motivation.

The second research question looked into whether digital gamification significantly influenced Iranian EFL learners' SRL. In contrast to the improvements observed in vocabulary development, the results for SRL were more complicated. Although both the experimental and control groups demonstrated improvement in SRL from pre- to post-test—suggesting a general developmental trend over the semester—no statistically meaningful difference was observed between the two groups. This finding indicates that the gamified intervention did not confer a distinct advantage in fostering SRL beyond that achieved through conventional instruction. This null effect aligns with recent empirical evidence questioning the automatic transfer of gamification benefits to self-regulatory processes. For instance, Brito et al. (2024) reported no significant differences in SRL between gamified and non-gamified conditions within an intelligent tutoring system, attributing the outcome to contextual and design-related factors. Similarly, Slamet and Basthomi (2024) found that learners in gamified environments often struggled with task prioritization, strategic resource use, and sustained self-control, underscoring the need for more deliberate instructional scaffolding. The present findings reinforce this position, suggesting that gamification alone—particularly when oriented toward engagement and competition—may be insufficient to produce measurable gains in complex metacognitive constructs such as SRL. Importantly, this study is subject to limitations that may have constrained the detection of SRL-related effects. The 12-week duration, while adequate for vocabulary development, may have been too short to yield substantial changes in learners' self-regulatory behaviors, which typically develop gradually and require sustained practice. Moreover, the gamified intervention did not explicitly incorporate SRL-focused training components such as goal-setting, strategic planning, self-monitoring, or reflective evaluation. This design choice may explain why improvements in engagement did not translate into differential SRL gains. While prior studies have reported positive effects of gamification

on SRL (e.g., Li et al., 2022; Cortes & Carreño-Bolivar, 2024; Alhalafawy & Zaki, 2022; Namaziandost et al., 2025), these outcomes often involved explicit metacognitive scaffolding embedded within the gamified framework. Future research should therefore adopt longitudinal designs and integrate targeted SRL instruction into gamified tasks to more rigorously examine causal relationships. Such approaches would help clarify the conditions under which gamification can move beyond motivational enhancement to support the development of durable self-regulatory competencies.

Interpreting this outcome through theoretical frameworks provides further insight. Zimmerman's (2000) SRL theory posits that effective self-regulation involves a cyclical process of forethought (goal-setting and planning), performance (self-monitoring and strategy use), and self-reflection (self-evaluation and adjustment). The gamified environment in our study did touch on these elements (for example, learners received instant feedback that could aid self-monitoring). Furthermore, this study might not have sufficiently engaged the forethought and self-reflection phases that are critical for actual self-regulatory improvement. Similarly, the study did not incorporate explicit metacognitive training or guided reflection sessions, which are often necessary to teach students how to apply the feedback they get from a system toward adjusting their learning strategies. In the absence of such explicit SRL scaffolding, students in the gamified group may have enjoyed the learning process and tried to complete the game tasks. However, they might not have systematically planned or reflected on their learning as much as the control group did. Self-Determination Theory and related motivational perspectives support this interpretation.

While the gamification was successful in boosting engagement (indicative of high motivation), motivation alone does not equate to self-regulation. Learners can be highly motivated to play and still not engage in effective study strategies, especially if extrinsic rewards are prominent. Flow Theory (Csikszentmihalyi, 1990) also provides a lens: learners in the gamified condition may have been in a state of flow, deeply absorbed in the tasks, which is excellent for engagement, but during flow, they might focus on in-game goals (e.g., scoring points or finishing levels) rather than broader learning goals. In other words, the gamified tasks could have, to some extent, externalized the locus of regulation to the game's structure—learners followed the game cues and challenges, perhaps without needing to initiate their own planning or adjustments as much as one would in a less structured environment. Additionally, the extrinsic vs. intrinsic regulation should be considered. Gamified systems often use external rewards (points, badges, leaderboards) to motivate behavior. While these can kick-start engagement, research cautions that heavy reliance on external rewards can undermine the development of intrinsic self-regulation; students may become dependent on the reward structure and not internalize the regulation of learning for its own sake. In our study, it is possible that the game incentives highly engaged the experimental group's learners, but those incentives did not translate into better self-regulatory strategy use once the incentives were removed or compared to peers who learned via conventional methods.

Evidence related to the third research question confirmed that digital gamification had a robust and statistically notable positive effect on Iranian EFL learners' engagement. The improvement spanned behavioral, emotional, and cognitive dimensions, demonstrated by participants' greater attentional focus, sustained participation, and enthusiasm. These outcomes are strongly aligned with established motivational and educational frameworks. Self-Determination Theory (Deci & Ryan, 1985) offers a conceptual explanation, suggesting that gamified features like choice, feedback, and collaborative challenges effectively support autonomy, competence, and relatedness, thereby promoting intrinsic motivation. Furthermore, flow theory (Csikszentmihalyi, 1990) accounts for the deep concentration and emotional investment observed, as the structured, goal-oriented nature of game tasks creates immersive learning experiences. Together, these perspectives reinforce the empirical conclusion that gamification, when implemented thoughtfully, is a powerful catalyst for enhancing sustained learner engagement in language education. Empirical studies strongly support these observations. For example, Tsai (2024), Aeni et al. (2024), Esquivel Vera et al. (2021), and Safdar et al. (2025) confirmed that gamified language learning significantly improved both learner engagement and performance in EFL settings, particularly through adaptive challenges and personalized feedback.

However, not all engagement effects are sustainable. Hanus and Fox (2015) found that initial engagement benefits from gamification diminished over time unless game elements were regularly updated to maintain interest. They added that the optimal balance between challenge and skill must be periodically recalibrated to prevent superficial engagement, such as point-collecting, from eclipsing deeper learning outcomes. Similarly, Cheraghi and Omranpour (2023) reported that competitive elements initially boosted motivation but later caused anxiety and disengagement, particularly among lower-performing students. Majuri et al. (2018) also warned that superficial engagement may arise if learners focus more on accumulating points than on understanding content. Shortt et al. (2023) noted that reward-based systems can lead to extrinsic dependency and eventual burnout if not balanced with meaningful learning activities.

### Conclusion and Implications

The outcomes of the present study found that digital gamification had a statistically notable effect on the vocabulary development of Iranian EFL learners. This outcome can be attributed to the suitability of gamified features—such as feedback, interactive tasks, and progress tracking—for learners who possess some foundational knowledge but still require structured support. Accordingly, it can be concluded that digital gamification is particularly beneficial for learners at intermediate stages. Although slight improvements in SRL were observed among learners who participated in the gamified instruction, these changes were not statistically significant. It can be inferred that while gamification has the potential to support aspects of SRL, its short-term implementation in this context did not result in substantial measurable gains. Furthermore, the statistically significant effect of digital gamification on learner engagement can be attributed to features such as immediate feedback, interactive challenges, and visual progress indicators. These elements are believed to have contributed to more active participation and interest, suggesting that gamification can be considered a promising approach for enhancing learner engagement in EFL contexts.

Pedagogically, the study's findings support a strategic redesign of Iranian EFL instruction focusing on learner-centered, data-informed gamification. The observed vocabulary gain suggests that integrating points, missions, and adaptive review cycles into standard classroom routines can transform repetitive lexical practice into a motivating, high-yield process. Furthermore, the engagement gains observed suggest that gamified dashboards and cooperative quests create a psychologically safe environment for shy or lower-proficiency learners to engage in English. Ebadi et al. (2024) similarly found that gamification fosters behavioral, emotional, cognitive, and agentic engagement, consistent with ecological systems. To maintain these benefits, designers should follow Hanus and Fox's (2015) recommendation to refresh or rotate game elements at regular intervals. Iterative content updates, seasonal quests, and learner-generated challenges can preempt motivational decline and sustain long-term engagement. Institutional support will be essential and should include professional development to help teachers align extrinsic rewards with meaningful communicative tasks and schedule periodic updates; reliable infrastructure to support mobile and browser-based delivery; and culturally responsive localization of narratives, avatars, and feedback features to ensure relevance for Iranian EFL learners. In fact, educators should take into account learners' needs, preferences, and attitudes towards technology while resorting to technology-mediated instruction (Kheiri et al., 2019) and instead of considering some specific mode preferences, try to provide them with a diversity of learning chances and experiences (Shahini & Hashemi Toroujeni, 2023).

Although this study substantiates the opportunities afforded by digital gamification for vocabulary and engagement, several limitations need attention. Learner variability in responding to game mechanics requires differentiated design. Successful implementation depends on reliable technology access and digital literacy. Critically, excessive dependence on extrinsic rewards has the potential to erode intrinsic motivation, and motivational fatigue is a risk without content refreshment. Effectiveness also relies on teacher readiness and training in game-based pedagogy. Future research should prioritize extending the temporal framework to assess long-term learning durability and diversifying the sample across ages and other proficiency levels. Targeted investigations into SRL are necessary to understand which metacognitive subcomponents are most responsive to gamification.

Comparative, cross-cultural studies and analyses of specific game elements are also recommended to provide a more detailed, empirically validated grasp of gamification's contribution.

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