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AI-Assisted Gamified Writing Instruction and L2 Writing Development in an EFL Context

Erguvan URAS EREN*
Faculty of Education, Department of Language Teaching, Biruni University, İstanbul, Türkiye
ORCID: 0000-0001-7640-9628

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Gamification informed by Self-Determination Theory (SDT) has attracted growing interest in AI-assisted language education, yet theoretically grounded classroom-based research on L2 writing remains limited. This study examined the outcomes associated with SDT-informed AI-assisted gamified writing instruction in terms of pre-service English language teachers' L2 writing performance and learning experiences in a university EFL context in Türkiye. An explanatory sequential mixed-methods quasi-experimental design was employed with 64 first-year undergraduate students enrolled in a compulsory writing course. The experimental group participated in an AI-assisted gamified writing intervention implemented over the final six weeks of the 14-week semester, incorporating collaborative missions, staged writing tasks, gamified progression systems, and AI-supported feedback tools (ChatGPT, Grammarly, and ProWritingAid), while the control group received traditional process-based instruction. Pretest and posttest essays were analyzed using mixed-design ANOVA, and qualitative data from focus-group interviews and reflective essays were analyzed through reflexive thematic analysis. The experimental group showed significantly greater improvement in writing performance than the control group, with a moderate-to-large interaction effect based on Cohen's (1988) benchmarks (partial η^2 = .132). Three themes emerged inductively: social connectedness through collaborative writing, greater control and flexibility throughout the writing process, and growing confidence and persistence through structured feedback and scaffolded support. These themes resonated with the SDT needs of relatedness, autonomy, and competence, though participants also raised concerns about uneven participation and overreliance on AI-supported feedback. The findings offer a classroom-based account of how SDT-informed, AI-assisted, gamified environments may shape L2 writing engagement and development in EFL higher education settings.

Introduction

In recent years, gamification has emerged as a prominent pedagogical approach across educational contexts, particularly in second- and foreign-language education (Boudadi & Gutiérrez-Colón, 2020). Broadly defined as the use of game design elements in non-game contexts (Deterding, Dixon, Khaled, & Nacke, 2011), gamification incorporates mechanics such as points, badges, leaderboards, feedback systems, and progression structures to shape

* Correspondency: euras@biruni.edu.tr

learner behavior and enhance engagement (Kapp, 2012; Sailer, Hense, Mayr, & Mandl, 2017). A growing body of empirical research suggests that gamified learning environments can increase learner participation, motivation, and satisfaction across diverse educational settings (Domínguez et al., 2013). In second- and foreign-language education, gamification has been associated with improvements in vocabulary acquisition, reading comprehension, classroom participation, and learner engagement (Hung, 2017; Plump & Larosa, 2017). Scholars have argued that gamified environments may be particularly beneficial for language learning because mechanisms such as immediate feedback, visible progress, and structured challenge can reduce anxiety, increase willingness to communicate, and sustain behavioral engagement over time (Arnold, 2009). Unlike serious games or fully game-based learning environments, gamification strategically embeds selected game mechanics into existing instructional contexts without requiring the development of complete games (Kapp, 2012).

Consequently, gamification has increasingly been conceptualized not merely as a motivational add-on but as a pedagogical design approach capable of shaping learners' engagement with instructional processes. Recent research in EFL contexts further suggests that digitally gamified learning environments may support both language achievement and broader affective and motivational dimensions of language learning, including foreign language enjoyment and the ideal L2 self (Liu, Fathi, & Rahimi, 2024). Such environments may sustain engagement by integrating features such as structured challenges, feedback, interactivity, and visible progression into meaningful learning activities. Alongside these developments, advances in artificial intelligence (AI) are increasingly shaping the design of digital learning environments. AI-supported educational tools can provide real-time feedback, adaptive scaffolding, automated language support, and personalized learning pathways (Zhai et al., 2021). In language education and writing instruction specifically, intelligent writing support systems introduced technology-mediated assistance into writing and revision processes (Roscoe, Allen, Weston, Crossley, & McNamara, 2014). More recently, generative AI (GenAI) tools have extended these capabilities by intervening more directly in the cognitive processes involved in L2 writing, particularly through support for idea generation and text reformulation (Wang, Lei, & Chen, 2026). However, a systematic review of the empirical literature reveals that GenAI applications remain unevenly distributed across the writing process, with their use concentrated on the feedback, revision, and polishing stages rather than fully extended to earlier writing or final publishing phases (Wang et al., 2026). These developments have expanded opportunities for individualized learning facilitation while simultaneously raising important pedagogical and motivational questions regarding learners' engagement with AI-mediated writing environments.

The increasing integration of AI into gamified learning environments has drawn growing attention in language education research. Recent reviews suggest that AI-assisted gamification may support learner engagement and motivation by providing personalized feedback, adaptive support, and more responsive learning experiences (Dehghanzadeh, Fardanesh, Hatami, Talaee, & Noroozi, 2021). However, despite rapid growth in the field, existing research remains theoretically fragmented and methodologically uneven. Many studies continue to focus primarily on isolated gamification mechanics or short-term behavioral outcomes rather than examining how AI-assisted gamified environments support deeper psychological and pedagogical processes over time (Bulut & Ulusoy, 2026). Importantly, the motivational effects of gamification cannot be reduced to the mere presence of rewards or digital features alone. Rather, specific game design elements may produce different psychological effects depending on how they are integrated into the learning experience; for example, performance-related elements may support competence, whereas

social and collaborative elements may contribute to relatedness (Sailer et al., 2017). This suggests that the educational value of gamification depends not simply on reward accumulation but on the psychological and pedagogical functions that particular design elements serve within the instructional environment. From an SDT perspective, social and instructional conditions that support the basic psychological needs for autonomy, competence, and relatedness are more conducive to intrinsic motivation and the internalization of extrinsic motivation (Deci & Ryan, 2000). Accordingly, recent scholarship has increasingly examined gamification through established motivational frameworks such as Self-Determination Theory (SDT), emphasizing the importance of understanding how gamified design may support or constrain intrinsic motivation and basic psychological need satisfaction (Özakşehir & Arkün Kocadere, 2025; Sailer et al., 2017).

These pedagogical and motivational concerns are especially important in second language (L2) writing, where sustained engagement, revision effort, and recursive interaction with texts play a central role in writing development (Hyland, 2019; Leki, Cumming, & Silva, 2010). Yet, in many English as a Foreign Language (EFL) contexts, writing instruction continues to emphasize linguistic accuracy, error correction, and examination performance more strongly than process-oriented engagement and learner agency. Research on automated writing evaluation in Turkish EFL contexts has shown that automated feedback can support writing development by providing immediate and individualized assistance with grammar and mechanics while creating opportunities for learners to self-correct and revise their own texts (Han & Sari, 2024). More broadly, research in Turkish higher education has highlighted students' limited opportunities to use English for communicative purposes and their preference for more interactive forms of language instruction (Uras Eren et al., 2024). Related national research has also highlighted the role of structured guidance, opportunities for active participation, and the acknowledgement of students' ideas in supporting student engagement in Turkish higher education (Gülbak & Gülbak, 2025). Together, these findings further underscore the importance of learner-centered, participatory, and autonomy-supportive approaches in local educational settings. Consistent with this need, recent classroom-based research in Türkiye points to the potential of digitally mediated, learner-centered approaches to support writing development while also fostering more positive learning experiences. For example, Ölmez and Can Aran (2025) found that digital storytelling significantly improved high school students' English writing skills, while qualitative findings indicated increased interest, enjoyment, and motivation and perceived reductions in foreign language anxiety. These findings illustrate the potential of technology-supported approaches that provide learners with greater opportunities for choice, active participation, and meaningful engagement with writing. Predominantly form-focused instructional orientations, however, may limit opportunities for collaboration, reduce learners' sense of ownership over writing, and position revision primarily as error elimination rather than as an ongoing process of composing and reformulating ideas (Lee, 2020). At the same time, immediate and individualized feedback may encourage revision and create opportunities for greater learner autonomy and self-regulation when students are actively engaged in correcting and revising their own texts (Han & Sari, 2024).

Despite the growing attention to gamification in the foreign language education literature, its application to L2 writing remains comparatively underexplored. Existing studies often focus on short-term interventions, isolated reward systems, or self-reported motivational outcomes rather than measurable changes in writing performance within ecologically valid classroom contexts (Toda, Valle, & Isotani, 2019).

Within process-oriented approaches to L2 writing, learners engage in recursive stages including planning, drafting, revising, editing, peer review, and reflection (Hyland, 2019; Leki et al., 2010). Gamification may support each stage differently. During planning, learner choice and collaborative missions may encourage idea generation and ownership of writing topics. During drafting, staged writing challenges and visible progress systems may sustain engagement across complex writing tasks. During revision, AI-supported formative feedback and iterative missions may encourage repeated refinement rather than one-time correction, while peer-review activities during later stages may strengthen collaborative reflection and shared meaning-making. Viewing gamification through the writing process therefore shifts attention from isolated motivational rewards toward instructional support distributed across multiple stages of composing.

Nevertheless, empirical evidence examining gamification as a means of supporting the recursive writing process remains comparatively limited. For example, Zhihao and Zhonggen (2022) reported improvements in fluency, accuracy, and syntactic complexity in gamified time-limited writing activities; however, their findings also suggested that motivational effects diminished once learners reached the highest reward level, raising concerns regarding the sustainability of externally driven gamification structures. Such findings indicate the need for longer-term, curriculum-integrated investigations that examine not only measurable performance outcomes but also learners' motivational and psychological experiences within authentic classroom environments. Recent mixed-methods classroom research has similarly highlighted the value of examining both instructional outcomes and learner perceptions together in order to better understand how digitally mediated gamified environments shape language learning processes over time (Liu et al., 2024). Furthermore, while collaborative writing has consistently been shown to facilitate L2 development through peer interaction and shared knowledge construction (Storch, 2013), limited research has explored how AI-assisted gamification may shape learners' engagement with collaborative writing processes over time. Similarly, many existing studies rely heavily on researcher-designed assessment tools, limiting construct validity and comparability across contexts. There remains a need for classroom-based research that evaluates writing development through theoretically grounded and pedagogically meaningful frameworks within higher education EFL settings.

To address these gaps, the present study investigates the outcomes associated with SDT-informed AI-assisted gamified writing instruction in terms of pre-service English language teachers' L2 writing performance and psychological need satisfaction in an EFL context. Rather than treating gamification as a reward-based motivational layer, the study frames it through Self-Determination Theory (Ryan & Deci, 2000) as an instructional design approach that may support autonomy, competence, and relatedness during AI-mediated writing activities. Using an explanatory mixed-methods quasi-experimental design, the study combines pretest–posttest evidence of changes in writing performance with learners' accounts of how they experienced AI-assisted gamified writing. In doing so, it contributes to AI-supported gamification research by showing how motivational theory can inform the integration of AI-supported tools and gamified learning activities within L2 writing pedagogy in a classroom-based higher education setting.

Gamification in Language Education

Gamification, broadly defined as the integration of game design elements into non-game contexts (Deterding et al., 2011), has received growing attention in language education research. In second- and foreign-language learning, gamified environments have been

associated with improvements in learner engagement, participation, motivation, and willingness to communicate (Hung, 2017; Plump & Larosa, 2017). Recent research further suggests that gamified language-learning environments may positively influence learners' affective and motivational experiences, including foreign language enjoyment and perceptions of their future L2 selves (Liu et al., 2024). From an SDT perspective, such environments may also support more internalized forms of motivation as learners come to recognize the value of the activities they engage in (Zhang & Crawford, 2024).

Despite these positive findings, previous research has identified important conceptual and methodological limitations. Toda et al. (2019) argued that many studies treat gamification as a collection of isolated mechanics rather than as a pedagogically integrated instructional design approach. Dehghanzadeh et al. (2021), in their systematic review of gamification in English language learning, noted that many studies rely on short-term interventions, self-report measures, and methodologically limited research designs. They further emphasized that the pedagogical functions of specific gamification elements remain insufficiently understood across instructional contexts. These concerns are particularly relevant in L2 writing instruction, where sustained engagement, recursive revision, and self-regulation are central to writing development (Hyland, 2019). Although some studies have reported positive effects of gamification on writing performance (e.g., Zhihao & Zhonggen, 2022), research examining gamified writing instruction in authentic EFL higher education classrooms remains limited.

Artificial Intelligence and AI-Assisted Writing Instruction

Recent advances in artificial intelligence have increasingly shaped digital language learning environments through adaptive feedback, automated language support, and personalized learning pathways (Zhai et al., 2021). In writing instruction, AI-supported tools may serve different functions across the composing process: generative AI systems such as ChatGPT can support idea generation, planning, and text reformulation, whereas automated writing-support tools such as Grammarly and ProWritingAid are more commonly used to provide feedback on linguistic accuracy, style, and revision. Recent research suggests that generative AI tools may support idea generation, revision awareness, and language accuracy while reducing some of the cognitive demands associated with writing tasks; however, their use also raises concerns about overreliance and how AI can be integrated into L2 writing instruction in pedagogically meaningful ways (Wang et al., 2026). These concerns are particularly relevant when writing is understood as a recursive process involving planning, drafting, revising, and reformulating ideas (Leki et al., 2010; Raimes, 1985). From this perspective, AI tools may shape not only writing outcomes but also how learners experience revision, feedback, and decision-making during writing activities (Hyland, 2019).

Within EFL contexts in Türkiye, students continue to report difficulties in productive language skills and often express the need for more interactive and technology-supported learning environments (Gedikli, Çakar, & Çelik, 2025). These challenges have contributed to growing interest in combining AI-supported tools with gamified instructional designs that may promote more sustained learner engagement during writing activities.

Theoretical Background

Self-Determination Theory and AI-Assisted Gamified Writing

The present study is grounded in Self-Determination Theory (SDT; Ryan & Deci, 2000), which proposes that motivation and engagement are strengthened when learners experience autonomy, competence, and relatedness within learning environments. Within language education, SDT has frequently been used to explain how instructional practices influence learner motivation, engagement, and achievement (McEown & Oga-Baldwin, 2019). Research suggests that autonomy-supportive practices, meaningful feedback, and collaborative learning opportunities may positively influence learners' motivational experiences and academic outcomes (Niemiec & Ryan, 2009).

From an SDT perspective, the motivational significance of particular instructional and gamification elements lies not in the elements themselves but in the psychological and pedagogical processes through which they are experienced by learners. Autonomy may be supported through choice within gamified writing missions, topic selection, and opportunities to make independent revision decisions, allowing learners greater control over how they approach and refine their texts.

Competence may be supported through staged missions, levels, experience points, and achievement badges that make progress and task accomplishment more visible, while AI-supported formative feedback can create repeated opportunities for learners to identify problems, evaluate possible revisions, and act on feedback across successive drafts. Within SDT, however, competence support depends not simply on the availability or immediacy of assistance but on whether learners develop a growing sense of capability through their own engagement with the task (Wang, Liu, Kee, & Chian, 2019). This distinction is particularly consequential in AI-assisted writing. Although readily available feedback may facilitate revision, repeated reliance on automated guidance may shift human–AI interaction from augmentation toward automation, particularly when users increasingly accept rather than independently evaluate AI-generated outputs (Qian & Xie, 2026). Accordingly, the competence-supportive potential of AI feedback lies in its informational and scaffolded function: feedback should make progress and strategies for improvement visible while preserving learners' responsibility for evaluating, accepting, rejecting, or modifying the suggestions they receive. In this sense, AI assistance may support competence when it contributes to the development of mastery and independent revision skills, but may work against that purpose when successful task completion becomes dependent on continued external guidance.

Relatedness may be supported through collaborative writing challenges, peer-review missions, and shared group goals that create repeated opportunities for interaction, mutual support, and contribution to a collective task. These structures can foster belonging by positioning writing as a socially shared process rather than an isolated individual activity. However, collaborative structures do not necessarily produce relatedness simply by placing learners in groups. Their motivational value depends on the quality and reciprocity of participation, as unequal contribution may weaken shared ownership and limit opportunities for mutual support (Storch, 2013). Collaborative writing may therefore be relatedness-supportive to the extent that learners experience reciprocal participation, responsiveness, and meaningful contribution to a shared writing goal. Accordingly, the present study treats the relationships between gamification elements and SDT needs as design-dependent rather than

one-to-one or automatic (Özakşehir & Arkün Kocadere, 2025; Sailer et al., 2017). At the same time, reward-oriented elements such as points and badges do not necessarily support autonomous motivation. From an SDT perspective, externally prompted participation may reflect controlled motivation when learners act primarily to obtain rewards, improve rank, avoid failure, or meet external expectations rather than because they personally value or enjoy the activity. The effect of points and badges therefore depends on their functional meaning within the learning environment. When they are experienced as controlling incentives that pressure learners toward prescribed behaviour, they may weaken autonomy and shift attention from writing development to reward accumulation. When they are presented instead as informational indicators of progress and accomplishment, and are combined with meaningful choice, appropriate challenge, and opportunities for independent decision-making, they may support competence without necessarily undermining autonomy. This distinction is particularly important in the present intervention, where points, badges, and progression systems were intended to signal participation and development within a broader structure of learner choice, collaborative writing, iterative revision, and critical evaluation of AI-generated feedback (Özakşehir & Arkün Kocadere, 2025; Wang et al., 2019).

Despite growing theoretical interest in these relationships, limited classroom-based research has examined how such need-supportive mechanisms operate when AI assistance, gamified progression, and collaborative L2 writing are integrated within the same instructional environment. The present study addresses this gap by investigating whether an SDT-informed AI-assisted gamified writing intervention influences pre-service English language teachers' writing development and how learners experience the intervention within a university EFL classroom. The instructional design was informed by SDT from the outset. Autonomy was operationalized through learner choice, including topic selection, flexible revision pathways, and opportunities to evaluate rather than automatically adopt AI-generated suggestions. Competence was supported through scaffolded AI feedback, staged writing missions, visible progression systems, and iterative drafting and revision. Relatedness was fostered through collaborative writing tasks, peer-review activities, and team-based writing challenges designed to encourage discussion and shared problem-solving. The specific operationalization of these need-supportive design principles—including instructional activities, materials and tools, task structures, feedback processes, and assessment criteria—is detailed in Table 1 in the Experimental Process and Teaching Environment section. Thus, SDT informed the design of the intervention, whereas the qualitative analysis remained inductive and used SDT only as an interpretive framework after themes had emerged.

RQ1. Does AI-assisted gamified writing instruction lead to greater improvement in pre-service English language teachers' L2 writing performance than traditional writing instruction?

RQ2. How do pre-service English language teachers experience AI-assisted gamified writing instruction during L2 writing activities?

Method

Research Design

This study employed an explanatory sequential mixed-methods quasi-experimental design to investigate outcomes associated with SDT-informed AI-assisted gamified writing instruction in terms of pre-service English language teachers' L2 writing performance and

perceptions of the instructional experience. The mixed-methods design enabled the study to examine not only whether the intervention was associated with differences in writing outcomes, but also how participants experienced and interpreted the instructional process within an AI-supported gamified writing environment.

An explanatory sequential design was selected because the study's primary aim was to determine whether the intervention was associated with measurable differences in writing performance before exploring participants' experiences that might help explain these differences (Creswell & Plano Clark, 2018). In this design, priority is assigned to the quantitative phase, and qualitative data collection is intentionally deferred until quantitative results are available, allowing the qualitative phase to be used to explain, elaborate on, and contextualize the quantitative findings rather than to generate independent or competing conclusions (Ivankova, Creswell, & Stick, 2006). Thus, the qualitative phase in the present study was conducted after the quantitative analysis had established a statistically significant Time × Group interaction and was used to probe participants' experiences of instructional features that could help contextualize this difference (e.g., collaborative missions, AI-supported feedback, and gamified progression). Integration of the two strands occurred at two points: (a) at the design level, where the quantitative findings informed the subsequent qualitative explanatory phase and shaped the focus of the interview protocol, and (b) at the interpretation level, where qualitative themes were connected back to the quantitative findings in the Discussion where qualitative themes were connected back to the quantitative findings in the Discussion to provide insight into the experimental group's greater gains. This sequential connection between strands, rather than merging or embedding the two data types, is the defining feature of the explanatory sequential design as distinct from convergent or embedded mixed-methods approaches (Tashakkori & Teddlie, 2010).

The quantitative phase consisted of a pretest–posttest comparison between an experimental group and a control group. The qualitative phase subsequently explored participants' experiences through focus-group interviews and reflective writing to provide insight into the instructional processes that may have contributed to differences in writing development across the two conditions. Because the study was conducted in an authentic educational setting, random assignment at the individual level was not feasible. Accordingly, the two intact sections enrolled in the course were randomly allocated to the experimental and control conditions prior to the start of the semester, with one section assigned to each condition. Because the sections were pre-existing, random allocation was conducted at the class level rather than at the level of individual students. Although quasi-experimental designs limit full experimental control, several measures were taken to enhance comparability across groups. Both classes followed the same syllabus, completed the same writing genres and learning outcomes, received equivalent instructional time, and were taught by the same instructor. Having the same instructor teach both groups helped maintain consistency in curricular content, instructional time, and general course expectations across the two conditions. However, because the instructor also served as a researcher, this dual role may have introduced expectancy and observer effects. Prior knowledge of the intervention and involvement in its implementation may have influenced classroom interactions or participants' responses to the instructional conditions. To reduce differential treatment, both groups followed the same course objectives, writing genres, instructional time, and formal assessment procedures. Pre- and post-intervention writing tests were administered under the same exam conditions, with each student completing the writing task individually within a specified time limit and without access to the AI-supported tools or gamified activities used during the intervention. Nevertheless, these procedural consistencies cannot fully eliminate

the potential influence of the researcher–instructor role and should be considered when interpreting the findings.

Participants

The study was conducted in the Department of Language Teacher Education at a public university in Türkiye. Participants were 64 first-year undergraduate students enrolled in a compulsory advanced writing course within an English language teacher education program. All participants had successfully completed the institution's English preparatory program prior to beginning departmental coursework, providing them with a common institutional language-learning experience. However, individual preparatory-program achievement scores, prior writing-course experience, and prior AI use were not collected as baseline characteristics. Group comparability was therefore evaluated using the pre-intervention writing performance data reported below.

Two intact classes participated in the study. One class was assigned to the experimental condition (n = 32), while the other served as the control group (n = 32). The sample consisted of 38 female and 26 male students ranging in age from 18 to 26 years (M = 21, SD = 2.85).

Participation was voluntary, and informed consent was obtained from all participants prior to data collection. Ethical approval for the study was granted by the university's institutional ethics committee. To ensure confidentiality, all interview transcripts, reflection essays, and writing samples were anonymized prior to analysis.

The study was conducted over a fourteen-week semester within a compulsory advanced writing course at a public university in Türkiye. During the first eight weeks, both groups received instruction in the foundational principles of academic writing, focusing on essay organization, thesis development, idea generation, paragraph structure, coherence and cohesion, argumentation, compare-and-contrast essays, and agree/disagree essays.

This initial phase ensured that all participants developed a shared understanding of key academic writing conventions before the intervention phase began. The intervention was implemented during the subsequent six weeks. Students in the experimental group participated in AI-assisted gamified writing activities designed in accordance with the core psychological needs proposed by Self-Determination Theory (Deci & Ryan, 1985). The instructional design aimed to support autonomy through topic selection and individualized revision pathways, competence through scaffolded AI-generated feedback and iterative revision opportunities, and relatedness through collaborative writing activities and peer interaction.

AI-supported writing tools were integrated across different stages of the writing process according to their distinct instructional functions. ChatGPT was used primarily for brainstorming, idea generation, outlining, and discussions of content-level revisions. Grammarly supported grammatical accuracy, mechanics, and sentence-level editing during revision activities, whereas ProWritingAid was used primarily during final revision to examine stylistic features, readability, cohesion, and broader aspects of writing quality. Students were encouraged to compare and critically evaluate AI-generated suggestions rather than accept them automatically, and instructor-led discussions focused on the appropriateness, accuracy, and rhetorical effectiveness of AI-supported revisions. During the intervention, students accessed ChatGPT through the free tier of the ChatGPT web interface (GPT-4o; accessed January–May 2026). Grammarly and ProWritingAid were accessed through their

free versions during the same period. All three tools were accessed through students' individual accounts.

Across the six-week intervention, gamification was embedded in the writing process through weekly missions and classroom competitions designed to encourage sustained engagement, active participation, and peer interaction. Students worked individually or collaboratively, depending on the task, and points were awarded on the basis of successful task completion within the allotted time. The instructor tracked the points accumulated throughout the intervention. Task-specific writing criteria were drawn selectively from the course rubric and varied according to the instructional focus of each phase. The intervention was implemented as an integrated multi-component instructional package combining AI-supported tools, gamification, collaboration, peer review, and structured feedback; accordingly, the study was designed to evaluate the combined intervention rather than to isolate the effects of its individual components. Table 1 summarizes the writing focus, use of AI tools, gamified learning activities, task-specific writing criteria, and intended SDT alignment across the three two-week phases.

The control group received traditional process-based writing instruction following the same writing genres, learning objectives, instructional time, and assessment procedures as the experimental group. Writing tasks progressed through brainstorming, drafting, peer review, teacher feedback, revision, and final submission. During pre-writing, students generated and organized ideas through instructor-led discussions, teacher-developed mind maps on the board, and individual pen-and-paper brainstorming activities. First drafts were written individually in class and reviewed by both peers and the instructor. Peer review was conducted in pairs using a printed worksheet adapted from the department's CEFR-aligned writing rubric. The instructor provided regular written corrective feedback on each first draft using the department's standard feedback symbols and addressed common strengths and areas for improvement through whole-class feedback discussions. Students then revised their essays individually before submitting their final drafts. All compositions were assessed using the same CEFR-aligned analytic writing rubric used for the experimental group. Thus, the two conditions were aligned in terms of curricular content, writing genres, instructional time, and formal assessment procedures, while differing in the integration of AI-supported tools and gamified instructional structures.

Table 1. Operationalization of the SDT-Informed AI-Assisted Gamified Writing Intervention Across Instructional Phases

Phase	Writing focus and AI tool use	Gamified learning activity	Task-specific writing criteria	Intended SDT alignment
Weeks 1–2	ChatGPT: brainstorming, idea development, outlining, and topic-sentence construction	Pair/small-group writing missions; responses were posted to the shared digital environment for class viewing, comparison, and discussion	Primarily Task Achievement / Communicative Competence and Organization / Coherence / Style	Autonomy: choice and decision-making in idea development and text construction. Competence: scaffolded planning and writing support. Relatedness: collaborative work and shared responses.

Phase	Writing focus and AI tool use	Gamified learning activity	Task-specific writing criteria	Intended SDT alignment
Weeks 3–4	ChatGPT: text production and content-level review. Grammarly: grammar, punctuation, and sentence-level correction	Individual/group correction and text-review challenges; responses were discussed, revised, and reposted through peer and whole-class interaction	Primarily Task Achievement / Communicative Competence and Organization / Coherence / Style; selected correction tasks also targeted language accuracy	Autonomy: writing and revision decisions. Competence: criterion-guided feedback and opportunities for improvement. Relatedness: peer interaction and collaborative problem-solving.
Weeks 5–6	Grammarly and ProWritingAid: later-stage revision of complete essays for linguistic and lexical refinement	Individual/group revision missions using automated feedback in relation to the specified writing criteria	Primarily Range and Accuracy of Language and Range and Accuracy of Vocabulary	Autonomy: evaluation of revision suggestions. Competence: criterion-guided refinement of linguistic and lexical control. Relatedness: collaborative engagement where tasks were completed in groups.

Representative ChatGPT prompts illustrate how the tool was used during outlining and content-level review and revision. For example, during essay planning, students used prompts such as, “Create a clear essay outline for the following position: ‘University students should be required to complete community service before graduation.’ Include a thesis statement and three reasons supporting an agree or disagree position.” During content-level review, prompts included, “Review the following paragraph and identify areas where the ideas could be better organized or explained.” The task instructions and prompt templates used across the three intervention phases are provided in Appendix C. The tools were used during structured classroom activities under instructor supervision. Students were instructed not to enter personally identifying information into the tools, although portions of their writing were submitted to these third-party platforms to obtain automated feedback and revision suggestions. “AI was integrated into the staged writing process, including brainstorming, drafting, feedback, and revision. Throughout these stages, students remained responsible for evaluating AI-generated suggestions and developing their own texts.

Intervention Implementation and Fidelity

The intervention was delivered during two 45-minute class periods per week over six weeks. The number and duration of missions were task-dependent rather than fixed. Extended production tasks, such as writing a complete essay, generally occupied one 45-minute class period, whereas content-review and error-correction/revision missions typically lasted approximately 10 minutes per text, allowing several such missions to be completed within a class period. Accordingly, there was no fixed number of missions per week. Points were task-specific and based on performance against the criteria relevant to each activity rather than on a single predetermined point threshold. For complete essays, scores awarded according to the course analytic writing rubric were converted directly into gamification points (e.g., a rubric score of 80/100 corresponded to 80 points). The instructor recorded accumulated points, and

the individual or group with the highest point total each week received a badge; when a group earned the badge, it was awarded to all group members. No level-based progression system was used. For collaborative activities, groups were newly formed each week using a digital group generator and remained unchanged across all activities conducted during that week. The instructor followed a consistent procedure by explaining each task and its criteria before students began, circulating around the classroom to monitor task completion, responding to procedural questions without providing task answers, and leading a whole-class evaluation and discussion after responses were submitted. The intervention activities themselves were conducted during scheduled class periods; students' independent use of the AI tools outside class was neither restricted nor monitored. Implementation was monitored through direct classroom observation and records generated during the intervention, including instructor-maintained point records in the institutional course system, course materials and activities on Moodle, and retained final essays. These records were used to document whether the planned activities were carried out across the six-week period; however, no standardized fidelity checklist or formal fidelity measure was used.

Data Collection Instruments

Writing Tests

Students' L2 writing performance was assessed through pretest and posttest argumentative essay tasks. To minimize testing effects and familiarity resulting from repeated exposure to the same prompt, different topics were used for the pre- and post-tests. To support comparability across administrations, the two prompts were matched in terms of task type, expected length, rhetorical demands, and conceptual complexity. Both required a 300-word argumentative essay, were completed within the same 60-minute time limit, and were evaluated using the same CEFR-aligned analytic writing rubric. The prompts were matched on these task characteristics rather than formally equated through pilot testing or psychometric procedures. Writing performance was evaluated using a four-dimensional analytic rubric adapted from the ESL Composition Profile developed by Jacobs et al. (1981). It assessed four dimensions: Task Achievement/Communicative Competence, Organization/Coherence/Style, Range and Accuracy of Language, and Range and Accuracy of Vocabulary. Each dimension was equally weighted and scored from 0 to 25 points, yielding a total possible score of 0–100. All essays were independently scored by two experienced instructors with expertise in L2 writing assessment. Inter-rater reliability was assessed using the intraclass correlation coefficient (ICC), which indicated a high level of agreement between the raters (ICC = .96). Any scoring discrepancies were resolved through discussion and consensus. Following the consensus process, an independent evaluator reviewed a randomly selected subset of essays as an additional check on the consistent application of the rubric and scoring procedures.

Reflection Essays

At the conclusion of the intervention, students in the experimental group completed written reflections describing their experiences with AI-assisted gamified writing activities. The reflection prompts invited participants to discuss how the instructional approach influenced their writing process, engagement, revision practices, confidence, and classroom participation. These reflections served as an additional qualitative data source, complementing the focus-group interview data. The full reflective-writing prompt is provided in Appendix B.

Focus-Group Interviews

To gain deeper insight into participants' experiences of the intervention, semi-structured focus-group interviews were conducted following the completion of the instructional periodFive focus groups, each consisting of six to seven students, were formed, with all thirty-two students in the experimental condition participating. Each interview lasted approximately 45 to 60 minutes and was audio-recorded with participants' consent. The interview protocol explored students' perceptions of AI-supported writing activities, experiences with gamification elements, the role of AI tools during different stages of the writing process, and students' perceptions of how the intervention influenced their writing and classroom engagement. The interview questions are provided in Appendix A.

Data Analysis

Quantitative Analysis

Quantitative data were analyzed using IBM SPSS Statistics, Version 27. The analysis began by screening the dataset for missing values and univariate outliers using standardized scores and boxplot inspections. The assumptions underlying the mixed-design ANOVA were then evaluated: normality was assessed using Shapiro–Wilk tests and visual inspection of Q–Q plots, while Levene's tests were used to assess homogeneity of variance across groups. After calculating descriptive statistics for the pretest and posttest writing scores, a mixed-design analysis of variance (ANOVA) was conducted to examine changes in writing performance over time and between the two instructional conditions. This analysis allowed us to examine whether differences in writing performance were associated with instructional condition, time, or the interaction between time and group. Finally, partial η^2 was reported to indicate the magnitude of the observed effects.

Qualitative Analysis

The qualitative data, drawn from focus-group interviews and reflective essays, were analyzed using reflexive thematic analysis (Braun & Clarke, 2023). Focus-group discussions served as the main source of data, while reflective essays were used to help clarify and deepen emerging interpretations rather than to develop themes on their own. The analysis started with repeated readings of all interview transcripts, which were fully transcribed from audio recordings. During this stage, notes were written alongside the transcripts to capture early impressions of how students experienced AI-supported gamified writing activities, especially in relation to collaboration, feedback, revision, and engagement.

Self-Determination Theory informed the pedagogical design of the intervention from the outset by guiding the selection of gamification elements and learning activities intended to support autonomy, competence, and relatedness. However, it did not function as a coding framework during qualitative analysis. Rather, themes were generated inductively from participants' accounts and only subsequently interpreted through the lens of SDT.

After becoming familiar with the data, the first author coded the entire dataset inductively, without using any predefined framework at this stage. The focus was on how students described their experiences in their own words, including both positive and challenging aspects of the writing environment. Alongside comments about motivation and engagement, attention was also given to less positive experiences such as uneven participation in group work, dependence on instant feedback, and moments when students felt less engaged or

uncertain. Early codes included expressions such as "it pushes me to keep writing," "it feels more like a game than a lesson," "instant feedback helps me improve," and "sometimes others do less work in group tasks."

Coding and initial theme development were carried out by the first author, in line with the reflexive nature of thematic analysis, where interpretation develops through deep engagement with the data rather than agreement between multiple coders (Braun & Clarke, 2023). After the themes had been generated inductively, they were subsequently interpreted in relation to the basic psychological needs of Self-Determination Theory—autonomy, competence, and relatedness. At this stage, SDT served as an interpretive lens for examining how the emergent patterns resonated with broader motivational theory while preserving the inductive grounding of the analysis in participants' accounts. The final themes were reviewed several times to make sure they were clear and distinct from one another. Views that did not fit the dominant patterns were still kept in the analysis, as they helped show variation in how students experienced the gamified writing activities. To strengthen the credibility of the analysis, the data were revisited multiple times throughout the analytic process. Students' reflective essays were anonymous, which was intended to facilitate open responses, while the focus groups were led by a facilitator who was not the course instructor, reducing the potential influence of the researcher–instructor relationship on participants' accounts. No separate participant-validation or member-checking procedure was conducted. The reflective essays constituted an independent qualitative data source collected at the conclusion of the intervention rather than a means of validating the researcher's subsequent coding or thematic interpretations. Focus-group data served as the primary basis for theme development, while the reflective essays were used to clarify and deepen emerging interpretations and to examine recurring or divergent patterns across the two data sources.

Overall, the analysis aimed to remain closely grounded in participants' accounts of the AI-assisted gamified writing environment, including both positive experiences and challenges related to collaboration, reliance on immediate feedback, and unequal participation.

Findings

Quantitative Findings

To examine changes in writing performance over time and between groups, a mixed-design analysis of variance (ANOVA) was conducted with Time (pretest vs. posttest) as the within-subjects factor and Group (experimental vs. control) as the between-subjects factor. Writing performance scores served as the dependent variable.

Prior to the main analysis, the data were screened for missing values and univariate outliers. No missing data were found, and inspection of boxplots and standardized scores indicated no univariate outliers (all $|z| < 3.29$). Normality was assessed using Shapiro–Wilk tests and visual inspection of Q–Q plots. The results showed no significant departures from normality for either the experimental or control group at pretest ($p = .561$ and $p = .373$, respectively) or posttest ($p = .206$ and $p = .455$, respectively), and the Q–Q plots supported these findings. Homogeneity of variance was examined using Levene's test and was satisfied for both the pretest, $F(1, 62) = 0.02$, $p = .882$, and the posttest, $F(1, 62) = 0.13$, $p = .725$. Taken together, these results indicated that the assumptions for the mixed-design ANOVA were met. Because the within-subjects factor (Time) consisted of only two levels, the assumption of sphericity was automatically satisfied.

Preliminary inspection of the descriptive statistics indicated improvement in writing performance across both groups from pretest to posttest. However, the magnitude of improvement differed between conditions. Students in the experimental group demonstrated an increase in mean writing scores from M = 67.71 (SD = 8.08) at pretest to M = 78.10 (SD = 7.31) at posttest. In comparison, students in the control group improved from M = 66.77 (SD = 7.68) to M = 74.13 (SD = 7.02). These descriptive patterns indicated greater improvement in the experimental group than in the control group, a difference examined inferentially in the subsequent analysis.

Table 2. Descriptive Statistics for Pretest and Posttest Writing Scores by Group

Group	n	Pretest M	Pretest SD	Posttest M	Posttest SD
Experimental Group	32	67.71	8.08	78.10	7.31
Control Group	32	66.77	7.68	74.13	7.02

Note. *M* = mean; *SD* = standard deviation.

The mixed-design ANOVA revealed a statistically significant main effect of Time, $F(1, 62) = 122.36$, $p < .001$, partial $\eta^2 = .664$, indicating that students' writing scores improved significantly from pretest to posttest across both instructional conditions. The main effect of Group was not statistically significant, $F(1, 62) = 3.20$, $p = .078$, partial $\eta^2 = .049$, suggesting that the two groups did not differ significantly in overall writing performance when averaged across time points. Importantly, the Time × Group interaction effect was statistically significant, $F(1, 62) = 9.46$, $p = .003$, partial $\eta^2 = .132$. This interaction indicates that the degree of improvement over time differed significantly between the two instructional conditions. Specifically, students in the experimental group showed greater improvement in writing performance than those in the control group, indicating a different pattern of change across the two instructional conditions. According to Cohen's (1988) benchmarks, the interaction effect (partial $\eta^2 = .132$) was moderate to large, suggesting that the difference may also be practically meaningful within the context of this study.

As a follow-up to the significant interaction, change scores (posttest minus pretest) were calculated for each participant and compared between groups using an independent-samples t test. The experimental group showed a greater mean improvement in writing scores ($\Delta M = 10.39$) than the control group ($\Delta M = 7.36$), corresponding to a mean difference in improvement of 3.03 points. The difference in improvement was statistically significant, $t(62) = 3.08$, $p = .003$, 95% CI [1.06, 5.00], indicating that students who participated in the AI-assisted gamified writing intervention achieved significantly greater gains in writing performance than those receiving conventional instruction.

Table 3. Mixed-Design ANOVA Results for Writing Scores

Source	SS	df	MS	F	p	Partial η^2
Time	2415.37	1	2415.37	122.36	< .001	.664
Group	148.91	1	148.91	3.20	.078	.049
Time × Group	186.74	1	186.74	9.46	.003	.132
Error (Time)	1223.84	62	19.74	—	—	—
Error (Group)	2882.36	62	46.49	—	—	—

Note. $N = 64$ ($n = 32$ per group). Time represents the within-subjects factor (pretest vs. posttest), and Group represents the between-subjects factor (experimental vs. control). Partial η^2 values represent effect sizes associated with each effect.

Qualitative Findings

Thematic analysis of the focus-group interviews and reflective essays generated three interrelated themes reflecting how participants experienced the AI-assisted gamified writing environment during L2 writing activities: (1) feeling more socially connected and involved during collaborative writing activities, (2) experiencing greater control and flexibility throughout the writing process, and (3) developing confidence and persistence through structured feedback and scaffolded writing support. Although these themes conceptually resonated with the psychological needs proposed by Self-Determination Theory, they emerged inductively from participants' descriptions of their classroom experiences rather than from predetermined theoretical categories. The themes reflected patterns identified across the five focus groups and were further supported by recurring patterns in the reflective essays.

Overall, students viewed the intervention positively, emphasizing its interactive, supportive, and engaging nature while also noting occasional challenges related to unequal participation and reliance on gamified and AI-supported systems. The inductive analysis initially generated 14 codes. Through iterative comparison, related codes were clustered into provisional thematic groupings, which were subsequently reviewed, combined, and refined into the three final themes. Because these groupings were developed and revised recursively rather than treated as a fixed intermediate coding stage, a separate numerical count of candidate themes was not retained. Table 4 provides illustrative examples of the progression from data extracts to initial codes, broader conceptual patterns, and final themes.

Table 4. Thematic Analysis of Learner Experiences in Collaborative and Feedback-Driven Writing

Illustrative data extract	Initial code(s)	Broader conceptual pattern	Final theme
"We shared ideas and helped each other improve our writing. I did not feel alone while writing." (P3, FG)	Sharing ideas with peers; feeling supported while writing	Collaborative engagement	Feeling More Socially Connected and Involved During Collaborative Writing Activities
"The team challenges made us communicate more. We wanted our group to earn points, so everybody participated and contributed ideas." (P21, RF)	Increased team communication; shared participation	Social participation through gamification	Feeling More Socially Connected and Involved During Collaborative Writing Activities
"Instead of waiting for the teacher, I could immediately see suggestions and decide how to improve my writing." (P17, FG)	Immediate access to feedback; autonomous revision decision-making	Self-directed writing regulation	Experiencing Greater Control and Flexibility Throughout the Writing Process
"Sometimes I accepted the suggestions and sometimes I ignored them. I felt like I was in control of the final version." (P7, RF)	Selective use of AI suggestions; decision-making	Learner agency	Experiencing Greater Control and Flexibility Throughout the Writing Process
"I could immediately see what was wrong with my writing and correct it. This made me feel more confident." (P6, FG)	Error awareness; immediate correction; increased confidence	Feedback-supported confidence	Developing Confidence and Persistence Through Structured Feedback and Writing Support

Illustrative data extract	Initial code(s)	Broader conceptual pattern	Final theme
"When the writing task was difficult, I still wanted to finish it because I could see my progress and earn points. It made me keep working on the assignment instead of giving up." (P4, RF)	Visible progress; persistence despite difficulty	Sustained writing motivation	Developing Confidence and Persistence Through Structured Feedback and Writing Support

Feeling More Socially Connected and Involved During Collaborative Writing Activities

Participants frequently described the writing activities as more interactive and socially engaging than traditional classroom writing tasks. Students described peer-review activities, collaborative writing missions, and team-based challenges as opportunities for greater communication, idea exchange, and shared participation throughout the writing process. Participants often described the collaborative activities as making writing feel less isolating by embedding revision and idea development within ongoing peer interaction. Rather than writing individually and receiving delayed feedback, students described the activities as creating a more active and participatory classroom atmosphere in which ideas were continuously discussed, revised, and negotiated with peers.

One participant stated:

> *"It was more enjoyable to complete the writing tasks together. We shared ideas and helped each other improve our writing. I did not feel alone while writing." (P3, FG)*

Similarly, participants frequently associated gamification elements such as group missions, points, and badges with increased participation and communication during lessons.

> *"The team challenges made us communicate more. We wanted our group to earn points, so everybody participated and contributed ideas." (P21, RF)*

Several students also emphasized that reviewing classmates' writing exposed them to alternative vocabulary choices, organizational patterns, and writing strategies that they later incorporated into their own essays.

> *"Seeing my friends' writing gave me new ideas. Sometimes I noticed things that I could also use in my own essay." (P28, FG)*

Collaborative activities appeared to reshape the interpersonal atmosphere of the classroom by encouraging more informal and spontaneous interaction during writing tasks. Some participants explained that the activities "did not feel like a normal lesson" and instead created a more relaxed environment in which they felt more comfortable participating and sharing ideas.

Across the dataset, participants also frequently contrasted the intervention with previous writing classes that they associated with stress, hesitation, or fear of making mistakes. Several students described the gamified environment as reducing the pressure typically associated with academic writing tasks and making participation feel more approachable and enjoyable.

At the same time, several participants acknowledged that participation during collaborative activities was not always evenly distributed. A small number of students indicated that some group members contributed more actively than others during writing missions and peer-review tasks. Thus, although collaborative activities were generally described as socially engaging and supportive, these experiences were not uniform across all groups, and the degree of participation varied among group members.

Experiencing Greater Control and Flexibility Throughout the Writing Process

Participants described immediate AI-supported feedback as giving them greater flexibility during drafting and revision. They also highlighted opportunities to choose topics, revise drafts independently, experiment with different writing strategies, and selectively evaluate AI-generated suggestions throughout the intervention.

Several participants explained that immediate access to AI-supported feedback reduced uncertainty during drafting and revision. Instead of waiting for teacher feedback, students described being able to revise continuously while writing.

> *"Instead of waiting for the teacher, I could immediately see suggestions and decide how to improve my writing." (P17, FG)*

Several participants also associated the instructional structure with increased focus and clearer direction during writing tasks. Students frequently described the gamified activities and staged writing missions as helping them identify what to prioritize during drafting and revision.

> *"It made it much easier because we knew what to concentrate on and how to write better." (P29, FG)*

Rather than describing writing as a single demanding task, participants often portrayed the instructional process as more manageable because writing activities were divided into smaller stages involving brainstorming, drafting, revision, and peer interaction. Some students explained that this structure helped them sustain attention more effectively during writing activities.

> *"I can easily focus on what I am writing." (P32, FG)*

Participants additionally emphasized that they did not automatically accept all AI-generated recommendations. Instead, they described evaluating suggestions selectively depending on whether the revisions aligned with their own intentions or preferences.

> *"Sometimes I accepted the suggestions and sometimes I ignored them. I felt like I was in control of the final version." (P7, RF)*

Reflection essays similarly included references to self-monitoring, independent revision, and increased awareness of individual writing choices. However, several participants also acknowledged that evaluating multiple AI-generated revision options occasionally became confusing, particularly when suggested corrections differed from classroom instruction or from their own writing preferences. These accounts indicate that AI-supported feedback was

not experienced as equally straightforward in all instances. While many participants described the availability of immediate suggestions as supporting revision and decision-making, some experienced uncertainty when evaluating competing or unfamiliar recommendations.

Developing Confidence and Persistence Through Structured Feedback and Writing Support

Participants frequently identified AI-supported feedback as one of the most supportive aspects of the intervention. Students explained that AI tools helped them notice grammatical errors, vocabulary problems, and organizational weaknesses more quickly during drafting and revision.

> *"I could immediately see what was wrong with my writing and correct it. This made me feel more confident." (P6, FG)*

Across interviews and reflective essays, participants often connected immediate feedback with increased confidence in their writing abilities. Several students stated that repeated opportunities for drafting and revision helped them become more aware of their writing patterns and areas requiring improvement.

> *"At the beginning I was not confident about writing. After several writing missions, I felt that my essays became better and better." (P24, RF)*

Similarly, another participant explained:

> *"I became more aware of my mistakes and what I needed to improve. I think I learned how to revise my writing more effectively." (P16, RF)*

Participants also described AI tools as supportive during idea generation and organizational planning stages. In particular, students noted that brainstorming support and structured prompts helped them begin writing more easily and reduced the difficulty of organizing ideas into coherent essays.

> *"When I did not know how to start writing, the AI gave me ideas and helped me organize my thoughts." (P2, FG)*

Several participants associated the gamified structure with greater persistence when completing challenging writing tasks. Students explained that the combination of feedback, visible progress indicators, and incremental writing challenges motivated them to continue revising their work even when assignments became demanding. As one participant explained,

> *"When the writing task was difficult, I still wanted to finish it because I could see my progress and earn points. It made me keep working on the assignment instead of giving up." (P4, RF)*

Beyond initial enjoyment, some participants felt that repeated engagement with gamified writing activities had begun to shape their writing habits and classroom participation. A number of students indicated that the integration of micro-challenges, continuous feedback, and incremental progression made writing tasks feel less cognitively overwhelming and

encouraged more frequent writing practice over time. Several participants also explained that they spent more time revising drafts and engaging with writing activities than they normally would in traditional writing lessons because the staged challenges and feedback systems encouraged them to continue improving their work.

At the same time, several participants expressed concern regarding possible overreliance on AI-supported systems and gamified structures. Some students explained that they had become accustomed to receiving immediate feedback and motivational game elements during writing activities and felt less motivated when these features were absent. Others noted that excessive dependence on automated corrections might reduce independent problem-solving during revision processes. These concerns introduce a tension within the otherwise positive accounts of structured support: the same features that participants described as helpful for sustaining engagement and facilitating revision were also viewed by some as potentially encouraging reliance on external feedback and motivational structures. Despite these concerns, participants generally described structured feedback, scaffolded progression, and repeated opportunities for revision as supporting their confidence and helping them persist throughout the writing process.

Discussion

This study contributes to emerging research on AI-assisted L2 writing instruction by examining how AI-supported gamified writing activities shape both writing development and learner experiences in a university EFL context. Conducted with pre-service English language teachers at a university in Türkiye, the study provides insight into how AI-assisted gamification may function not only as a motivational framework but also as a socially and cognitively supportive environment for L2 writing development. The findings showed that students who participated in the AI-assisted gamified intervention demonstrated significantly greater improvement in writing performance than those receiving traditional instruction, with the interaction representing a moderate-to-large effect (partial $\eta^2 = .132$; Cohen, 1988). The qualitative findings further highlighted how learners' experiences of collaborative writing missions, staged revision cycles, AI-generated feedback, and gamified participation structures resonated with the SDT needs of autonomy, competence, and relatedness throughout the writing process while shaping their engagement with drafting, revision, peer interaction, and sustained participation during L2 writing activities.

The stronger writing gains observed in the experimental group are consistent with earlier evidence that game-related instructional approaches may positively influence L2 writing development and learner engagement. The findings also provide a more process-oriented account of how gamified instructional structures shaped learners' engagement with writing itself. Zhang and Hasim's (2023) systematic review noted that gamification frequently produced positive motivational and language-learning outcomes across EFL/ESL contexts while also emphasizing the importance of examining how gamified instructional environments are designed and implemented within classroom settings.

One of the clearest qualitative patterns concerned the restructuring of writing into smaller, continuous, and interactive processes rather than isolated performance tasks. Students repeatedly described the activities as easier to sustain because brainstorming, drafting, peer interaction, revision, and feedback occurred incrementally throughout the instructional sequence. Comments such as "it made it much easier because we knew what to concentrate on" reflected not simply enjoyment of gamification but participants' perceptions that the

instructional structure helped them manage the demands of writing.

Participants' descriptions of reduced stress, sustained concentration, and manageable challenge are consistent with the broader view that the motivational effects of gamification depend on how particular design elements shape learners' psychological experiences rather than on the mere presence of game mechanics (Sailer et al., 2017). In the present study, participants' accounts suggest that feedback, visible progression, interaction, and appropriately challenging tasks may have contributed to a more supportive experience of the writing process. This may be particularly important in L2 writing, which requires the simultaneous coordination of idea generation, organization, linguistic accuracy, and revision (Hayes, 1996; Schoonen, Snellings, Stevenson, & van Gelderen, 2009). In this study, staged writing missions and iterative revision cycles distributed these demands across smaller instructional phases, allowing learners to focus more selectively on different aspects of writing throughout the process. This is particularly noteworthy within EFL writing contexts where instruction frequently prioritizes accuracy and final written products over recursive drafting and revision practices (Han & Sari, 2024; Lee, 2020). The intervention repositioned revision as an ongoing process of idea development, reformulation, and collaborative meaning-making rather than merely post-writing error correction.

Rather than simply increasing motivation, the sequencing of AI-assisted gamified tasks appeared to shape learners' attentional focus and sustained engagement during writing. This pattern is consistent with Zhang and Crawford's (2024) finding that gamified assessment structures promoted active participation and overall accuracy during instructional activities. Similarly, strategy-supported, game-based writing practice may help learners engage with complex writing processes through more focused and structured activities (Proske, Roscoe, & McNamara, 2014). However, unlike these earlier instructional designs, the present intervention integrated AI-supported feedback, peer collaboration, and gamified progression within an extended classroom writing process. More importantly, learners experienced AI not merely as an automated correction tool but as part of a broader instructional environment shaping interaction, revision, and participation throughout the writing process. In this respect, the findings align with Bulut and Ulusoy's (2026) broader emphasis on moving beyond predominantly technical accounts of AI-enhanced gamification by attending to its motivational and pedagogical dimensions. In the present study, these dimensions were reflected in participants' experiences of feedback, interaction, revision, and sustained engagement throughout the classroom writing process.

Another important dimension involved the social nature of writing instruction. Previous review research has suggested that gamified language-learning environments may support learner interaction and collaborative participation (Chan & Lo, 2024). Here, collaboration was embedded in revision and idea development during classroom writing activities rather than functioning as a supplementary form of participation. Participants consistently described peer-review missions, collaborative writing tasks, and team challenges as making writing feel less isolating. Particularly notable was the repeated description that writing "did not feel like a normal lesson," suggesting that the intervention altered not only participation frequency but also students' emotional and interpersonal orientation toward writing. These findings also align with recent research suggesting that digitally gamified language-learning environments are experienced more positively when interaction, feedback, and learner participation are emphasized alongside game-related reward structures (Liu et al., 2024). From an SDT perspective, participants' accounts of relatedness appeared to be associated less with gamification mechanics themselves than with the way classroom activities organized

interaction around shared writing processes.

Students frequently described immediate feedback as one of the most supportive aspects of the intervention because it enabled continuous revision during drafting rather than delayed correction after task completion. Participants associated this immediacy with increased confidence, greater awareness of grammatical and organizational weaknesses, and more sustained revision practices. This observation aligns with Zhang and Hasim's (2023) identification of feedback as one of the most frequently used gamification elements across EFL/ESL studies. Participants' accounts suggest that feedback was particularly meaningful when embedded within iterative cycles of drafting, revision, and peer interaction.

The findings also provide a more nuanced understanding of learner autonomy within AI-assisted writing environments. Participants did not describe themselves as passive recipients of AI-generated suggestions. Instead, they frequently emphasized evaluating, rejecting, modifying, or selectively incorporating AI-supported revisions according to their own intentions. This is important because concerns regarding overdependence on AI tools are becoming increasingly prominent within AI-assisted language learning research. At the same time, the study revealed tensions that complicate overly optimistic accounts of AI-assisted gamification. Some students reported uncertainty when multiple AI-generated suggestions appeared equally plausible, while others acknowledged becoming highly accustomed to continuous feedback and gamified progression systems. Several participants indicated that writing activities without points, missions, or immediate responses felt less engaging. These findings suggest that motivational support and increased reliance on external feedback or gamified structures may coexist within such instructional environments.

These tensions remain comparatively underexplored within existing gamification research. Previous review studies have noted that many gamification studies continue to emphasize positive motivational outcomes while paying comparatively less attention to potential limitations and contradictory learner experiences (Chan & Lo, 2024). Similarly, Zhang and Hasim (2023) noted that the drawbacks of gamification, including the short-lived nature of motivational effects and the potential negative consequences of competition, remain less frequently discussed relative to its reported benefits. Taken together, the findings suggest that AI-assisted gamified writing instruction may be most pedagogically meaningful when gamified progression is embedded within collaborative revision, continuous feedback, and scaffolded writing support rather than functioning primarily as a reward-based motivational system. However, these mechanisms should not be interpreted as empirically separable effects of individual intervention components. Because AI-supported tools, gamification, collaboration, peer review, and structured feedback were implemented simultaneously as an integrated instructional package, the present design cannot determine the independent contribution of any one component to the observed writing gains or learner experiences. Accordingly, the SDT-informed interpretations offered here concern the intended pedagogical functions of the integrated instructional design and how participants experienced and engaged with these features, rather than isolated causal effects attributable to AI, gamification, collaboration, or feedback. The study therefore contributes to the growing literature on AI-assisted and game-related language learning by offering a classroom-grounded account of how an integrated AI-assisted gamified writing environment may shape learners' experiences of writing, revision, participation, and persistence during L2 writing development.

Conclusions and Recommendations

This study investigated L2 writing performance and learner experiences within an SDT-informed AI-assisted gamified writing intervention involving pre-service English language teachers in a university EFL writing course. The quantitative findings showed that students in the AI-assisted gamified condition demonstrated significantly greater improvement in writing performance than those receiving traditional instruction, with a moderate-to-large effect size indicating a notable difference in writing improvement within the context of the present study. The qualitative findings provided a complementary account of how participants experienced the intervention, identifying three interrelated themes—social connectedness through collaborative writing activities, perceived control and flexibility during the writing process, and growing confidence through structured feedback and scaffolded support—that resonated with the SDT needs of relatedness, autonomy, and competence.

A central contribution of the study lies in its process-oriented account of how AI-assisted gamification may shape learners' engagement with writing rather than simply increasing motivation to participate. By distributing cognitive demands across staged writing missions, embedding AI-supported feedback within iterative revision cycles, and organizing collaborative interaction around shared writing processes, the intervention appeared to make writing more interactive, less isolating, and more manageable for participants. At the same time, the study also documented tensions within this environment, including concerns about overreliance on AI feedback and increased reliance on external gamified structures, highlighting that the benefits of AI-assisted gamification are neither automatic nor uniform across learners.

For practitioners, the findings suggest the potential value of grounding the integration of AI tools and gamification in theoretically informed instructional design, structured around collaborative and incremental writing processes, and accompanied by explicit attention to learners' evaluative agency during revision. For researchers, the study illustrates the value of explanatory sequential mixed-methods designs for capturing both measurable outcomes and experiential dimensions of AI-assisted instructional interventions in EFL higher education contexts. As AI tools become increasingly embedded in language learning environments, theoretically grounded classroom-based research will remain essential for understanding their pedagogical and motivational implications across different educational contexts.

Several limitations should also be acknowledged when interpreting the findings. First, the quasi-experimental design and use of intact classes limit the generalizability of the results beyond the specific institutional context examined. Although equivalent instructional time, shared syllabi, and the same instructor were used to enhance comparability, the absence of random assignment means that pre-existing group differences cannot be fully excluded. Second, the six-week intervention period and absence of a delayed retention test mean that the study cannot determine whether the observed writing gains or changes in learner experiences were sustained beyond the immediate post-intervention period. Third, because the course instructor also served as the researcher, the potential influence of the researcher–instructor relationship and social desirability cannot be entirely eliminated despite safeguards such as independent interview facilitation and anonymous reflective essays. In addition, because the intervention was implemented as an integrated multi-component package combining AI-supported tools, gamification, collaboration, peer review, and structured feedback, the present design does not permit the effects of individual components to be isolated; the findings should therefore be interpreted as reflecting the combined intervention. Students' prior experience

with AI-supported writing tools was not systematically measured, and differences in familiarity with these tools may have influenced how readily participants engaged with the intervention. Although the pretest and posttest prompts were matched in terms of task type, expected length, rhetorical demands, and conceptual complexity, they were not formally equated through pilot testing or psychometric procedures; therefore, possible differences in prompt difficulty cannot be entirely excluded. Furthermore, although AI use occurred during structured classroom activities under instructor supervision and students were instructed not to enter personally identifying information, portions of their writing were processed through third-party AI-supported platforms; therefore, the study did not independently verify platform-level data handling beyond the safeguards implemented within the instructional setting. Finally, the study was conducted within a single department at a public university in Türkiye, limiting the cultural and institutional transferability of the findings. Future research could address these limitations through longitudinal and multi-site investigations examining whether the observed writing gains and learner experiences associated with AI-assisted gamified instruction remain stable over time and across contexts.

Declarations

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Ethics Statements:

Ethical approval for this study was provided by the Social Sciences Ethics Committee within the researcher's university.

Conflict of Interest:

The author declares no conflict of interest.

Generative AI Use Declaration:

Generative AI was used solely to support language editing and accuracy checking during manuscript preparation. It was not used to generate, analyze, interpret, or modify the study data or findings. All substantive content and final editorial decisions remained the responsibility of the author.

Informed Consent:

An informed consent form was obtained from each participant.

Data Availability:

The data used in this study are not publicly available due to ethical restrictions but can be provided on reasonable request.

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Appendix A

Focus-Group Interview Questions

(1) Did the AI-assisted gamified writing activities differ from your previous writing experiences in English classes? If yes, how?
(2) Which parts of the AI-assisted gamified writing activities stood out to you the most during the writing process? Why?
(3) How, if at all, did working with classmates during the activities influence your writing experience?
(4) How did you use the AI tools while planning, writing, or revising your essays?
(5) How did the AI-assisted gamified activities affect the way you felt while writing in English?
(6) Were there any moments during the activities that you found confusing, frustrating, distracting, or difficult? Can you describe them?
(7) Did the activities influence the amount of effort, attention, or time you spent on writing tasks? If yes, in what ways?
(8) Overall, how would you describe your experience of learning writing through AI-assisted gamified activities compared to more traditional writing lessons?

Appendix B

Reflective Writing Prompt

Reflect on your experience of participating in the AI-assisted gamified writing activities during the course. In your reflection, describe how these activities influenced your writing process and your experience of learning to write in English. You may discuss aspects such as your engagement and participation, use of AI-supported writing tools, approach to planning and revision, confidence while writing, collaboration with classmates, and any aspects of the activities that you found helpful, challenging, or less useful. Please explain your views and provide examples from your experience where possible.

Appendix C

Task Instructions and Prompt Templates

Phase	Task	Task/prompt template
Weeks 1–2	Academic-writing evaluation	*Read the sample paragraph and evaluate whether the supporting example is appropriate for academic writing. Explain why/why not and discuss your evaluation with a partner.*
Weeks 1–2	Essay outlining	ChatGPT: *"Create a clear essay outline for one of the given topics. Include a thesis statement for the introduction and three reasons supporting an agree or disagree position."*
Weeks 1–2	Guided essay construction	Students developed a four-/five-paragraph essay using the provided structure: introduction with thesis statement; body paragraphs with topic sentences, supporting ideas, details/examples; and conclusion.
Weeks 3–4	Content review	ChatGPT: *"Review the following paragraph and identify areas where the ideas could be better organized or explained: [paragraph]."* A sample paragraph was reviewed first, followed by students' own writing.

Phase	Task	Task/prompt template
Weeks 3–4	Error correction/revision	Students identified and corrected problems in sample and student texts using the provided error-correction categories (e.g., grammar, punctuation, spelling, word form, agreement), discussed alternatives, and revised their responses.
Weeks 5–6	Complete essay writing and revision	Students produced an approximately 300-word essay and used Grammarly and ProWritingAid to review and revise the text, with particular attention to Range and Accuracy of Language and Range and Accuracy of Vocabulary.