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Enhancing Listening Comprehension in Non-English Majors through AI-Integrated Gamified Formative Assessment

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Abstract: Listening comprehension remains a persistent challenge for non-English major students, often due to passive learning approaches, limited interactive engagement, and ineffective assessment methods. Traditional formative assessment lacks real-time feedback and adaptive mechanisms, hindering students' ability to monitor progress and develop effective listening strategies. To address these drawbacks, the current study examines the implementation of an AI-integrated gamified formative assessment in enhancing listening comprehension among the 38 first-semester students at Universitas PGRI Delta Sidoarjo, a private university in East Java, Indonesia. Employing a sequential mixed-methods approach, data were collected from a closed-ended questionnaire measuring dimensions of engagement, motivation, and self-regulation, alongside structured interviews with six selected students to gain deeper insights. The findings reveal that the AI-integrated gamified platform fosters a more interactive and engaging learning experience, with students demonstrating increased autonomy and strategic listening behaviors. The instant feedback and adaptive challenges contributed to improved comprehension, particularly in recognizing key information and inferring meaning from context. However, some participants expressed difficulties in adapting to the dynamic nature of the platform, citing cognitive overload and challenges in managing time constraints within the game-based environment. Additionally, variations in AI-generated feedback quality occasionally led to confusion in interpreting certain listening tasks. These findings suggest that while AI-integrated gamification enhances listening comprehension, further refinements in feedback accuracy and cognitive load management are essential to optimize its pedagogical impact. The study provides critical insights for educators and developers in designing AI-driven gamified assessment tools that effectively support listening comprehension development for non-English majors.

Keywords: AI integration, Formative assessment, Gamification, Listening comprehension, Non-English Majors.

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Introduction

Listening comprehension is a critical component of language acquisition, serving as the foundation for effective communication and cognitive processing in English as a Foreign Language (EFL) learning. Unlike productive skills such as speaking and writing, listening is often perceived as a passive process, leading to its underemphasis in instructional settings (Pérez-Segura et al., 2022; Rukthong, 2021). This marginalization has resulted in traditional listening instruction that prioritizes exposure over strategic development (Alimorad & Saleki, 2022; Ramli et al., 2019), leaving non-English major students struggling to extract meaning from spoken discourse, especially in academic and professional contexts. Research has demonstrated that ineffective listening instruction stems from the predominant use of teacher-centered approaches that focus on comprehension questions rather than fostering interactive, process-oriented strategies (Mulyadi et al., 2021; Ngo, 2019). Consequently, students often fail to develop essential listening skills, such as identifying main ideas, inferring meaning from context, and distinguishing relevant details from extraneous information. This gap underscores the necessity of re-evaluating pedagogical practices and assessment methods in university-level EFL listening instruction, particularly for non-English major students who require English proficiency as a supplementary yet essential skill in their academic and professional endeavors.

Formative assessment has been widely recognized as an effective tool for improving language skills, particularly by offering continuous feedback, promoting self-regulation, and encouraging active engagement in learning (Stanja et al., 2023). In the context of listening comprehension, formative assessment provides learners with opportunities to monitor their progress, reflect on their listening strategies, and adjust their approaches accordingly (Slamet & Mukminatien, 2024). However, conventional formative assessment practices in university EFL classrooms tend to be paper-based or teacher-directed, limiting opportunities for personalized feedback and autonomous learning (Estrada-Araoz et al., 2023; Yang et al., 2022). Studies have shown that static assessment methods, such as multiple-choice listening tests, fail to capture the complexity of real-world listening situations, where meaning is co-constructed through context, speaker intention, and discourse structures (Rahman & Suryati, 2018; Yaniafari et al., 2020). Moreover, traditional feedback mechanisms in formative assessment often suffer from delayed responses, preventing students from making immediate adjustments to their listening strategies (Jia & Hew, 2022). These limitations suggest the need for a more interactive, adaptive, and learner-centered approach to formative assessment in

listening comprehension, particularly for non-English major students who may not receive intensive language training in their respective disciplines.

Gamification has emerged as a promising pedagogical innovation to enhance engagement and motivation in EFL learning (Romsi et al., 2024; Slamet & Basthomi, 2024), including listening comprehension. By integrating game-based elements such as point systems, challenges, and progress tracking, gamified learning environments have been shown to increase learner motivation, foster persistence, and enhance overall language acquisition (Landers, 2014; Slamet et al., 2024a, 2024b). In listening instruction, gamification can provide structured yet dynamic learning experiences that encourage students to actively participate, apply strategic listening techniques, and receive immediate formative feedback (Zainuddin et al., 2020). Studies have reported that gamified learning fosters a more immersive and interactive environment, reducing anxiety and promoting sustained engagement in listening tasks (Hutson et al., 2024; Zhang & Crawford, 2024). However, despite these benefits, research has also identified potential drawbacks, including cognitive overload, excessive competition, and the risk of learners prioritizing game mechanics over actual skill development (Al-Aosail et al., 2024; Zhang & Watson, 2025). While previous studies have explored gamification in EFL instruction, there remains a lack of research examining its role in formative listening assessment, particularly for non-English major university students who require English skills for general academic and professional purposes rather than deep linguistic mastery.

The integration of Artificial Intelligence (AI) into gamified learning environments presents new possibilities for optimizing formative assessment in listening comprehension. AI-driven educational platforms offer adaptive feedback, real-time error detection, and personalized learning trajectories based on individual learner performance (Leong et al., 2023; Qiao & Zhao, 2023; Slamet, 2024). In listening comprehension, AI has the potential to analyze student responses, detect comprehension gaps, and provide targeted support to enhance listening strategies (Parveen & Alkudsi, 2024; Villarino, 2025). Research on AI-assisted learning in EFL contexts has highlighted its ability to increase learner autonomy, facilitate individualized pacing, and improve overall language outcomes (An et al., 2023; Cooper, 2023; Memarian & Doleck, 2024). However, existing studies have also pointed to challenges, including inconsistencies in AI-generated feedback, technical limitations in speech recognition and comprehension assessment, and student difficulties in adapting to AI-driven interfaces (Bashori et al., 2022; Dai & Wu, 2023). While AI has been increasingly integrated into language learning applications, research on its application within gamified

formative assessment for listening comprehension remains scarce, particularly in the context of non-English major students in university settings.

Given these considerations, this study explores AI-integrated gamified formative assessment to enhance listening comprehension in non-English major undergraduates. Traditional listening instruction remains ineffective due to its passive nature, while formative assessment lacks immediacy and personalization. Although gamification boosts engagement, its role in listening assessment is underexamined. AI offers adaptive solutions but faces challenges in feedback accuracy and learner adaptability. This study bridges these gaps by investigating how AI-driven gamification optimizes formative assessment, fosters learner autonomy, and addresses instructional and technological limitations in university EFL contexts. This study is guided by the following research question: How does AI-integrated gamified formative assessment influence the listening comprehension development of non-English major undergraduate students?

Literature Review

The effectiveness of formative assessment in enhancing listening comprehension has been widely recognized in language education. Formative assessment provides continuous feedback, facilitates self-regulation, and helps learners monitor their progress in developing listening strategies (Köroğlu, 2021; Stanja et al., 2023). Listening instruction enables students to identify comprehension gaps, refine their approaches, and adjust strategies based on feedback (Slamet & Mukminatien, 2024). However, conventional formative assessment methods in EFL listening, particularly in university settings, remain limited in their ability to provide immediate and personalized feedback. Paper-based and teacher-directed assessments often result in delayed responses, preventing students from making real-time adjustments to their listening strategies (Köroğlu, 2021; Zhang & Crawford, 2024). Additionally, standard comprehension tasks, such as multiple-choice listening tests, fail to capture the complexity of real-world listening, where meaning is shaped by discourse structures, speaker intentions, and contextual nuances (Alimorad & Saleki, 2022; Yang et al., 2022; Zainuddin et al., 2020). Despite advancements in digital learning, there is still a lack of dynamic, technology-enhanced formative assessment models tailored to listening comprehension, particularly for non-English major undergraduates who require English proficiency for academic and professional communication rather than in-depth linguistic mastery. This gap underscores the need for a more adaptive, interactive, and technology-integrated approach to formative assessment in listening instruction.

Gamification has gained increasing attention as a means of improving engagement and motivation in language learning. According to Landers (2014), gamification refers to the use of game elements in non-game contexts to influence user behavior and learning outcomes. His theory emphasizes that gamification is most effective when it is grounded in instructional design principles, where game elements serve as mediators that enhance learning through increased motivation and engagement (Slamet et al., 2025). By integrating game-based elements such as points, levels, rewards, and challenges, gamified learning environments can encourage learners to engage with content actively and persist in skill development (Romsi et al., 2024; Slamet et al., 2024b; Slamet & Basthomi, 2024). In the context of listening comprehension, gamification can create interactive learning experiences that promote sustained attention, reduce anxiety, and enhance the retention of auditory information (Ngo, 2019; Rukthong, 2021). Research has shown that gamified learning fosters greater student participation and improves language acquisition by increasing intrinsic motivation (Afshar & Jamshidi, 2022; Sailer & Homner, 2020). However, existing studies on gamification in EFL contexts have largely focused on vocabulary acquisition, grammar learning, and overall language proficiency (Al-Aosail et al., 2024; Hutson et al., 2024; Slamet et al., 2024a), with limited attention given to its impact on formative listening assessment. Moreover, some studies have raised concerns about the potential drawbacks of gamification, such as cognitive overload, excessive competitiveness, and an overemphasis on rewards rather than skill development (Zhang & Watson, 2025). While gamification holds promise for increasing engagement, its application in listening instruction remains underexplored, particularly in terms of how it can be integrated into assessment frameworks that prioritize skill enhancement and strategic learning. Given these limitations, further research is needed to determine how gamified formative assessment can be designed to support listening comprehension development while maintaining a balance between motivation and pedagogical effectiveness.

The integration of AI in language learning has introduced new possibilities for adaptive assessment and personalized feedback. AI-driven educational tools can analyze student performance, identify specific comprehension difficulties, and provide tailored recommendations to improve learning outcomes (Leong et al., 2023; Qiao & Zhao, 2023). In listening comprehension, AI technologies have been leveraged to deliver speech recognition, automatic error detection, and real-time feedback, allowing learners to adjust their strategies accordingly (Qiao & Zhao, 2023). Studies have demonstrated that AI-assisted learning promotes learner autonomy and facilitates individualized pacing, which is

particularly beneficial in listening instruction, where students process auditory input at different rates (Memarian & Doleck, 2024; Qiao & Zhao, 2023). However, despite its potential, AI-driven formative assessment in listening comprehension remains underdeveloped. Many existing AI applications in language learning focus on automated writing assessment and pronunciation training, with fewer studies examining how AI can enhance listening skills through interactive and adaptive assessment models (Villarino, 2025; Yang et al., 2022). Additionally, challenges such as the accuracy of AI-generated feedback, limitations in recognizing diverse listening contexts, and students' adaptability to AI-driven learning environments have been identified as areas requiring further research (Chang & Sun, 2024; Parveen & Alkudsi, 2024). While AI presents promising solutions for real-time assessment, its integration into gamified formative listening assessment has not been extensively investigated. There is a need to explore how AI can be effectively combined with gamification to optimize listening comprehension assessment, ensuring both engagement and the development of essential listening strategies.

Methodology

Research Design and the Participants

This study employs a sequential mixed-methods research design to explore how AI-integrated gamified formative assessment influences the listening comprehension development of non-English major undergraduate students. A mixed-methods approach allows for a more comprehensive examination of the phenomenon by integrating quantitative and qualitative data, providing both generalizable findings and in-depth insights into students' experiences (Ivankova et al., 2006). The study begins with quantitative data collection through a closed-ended questionnaire to measure key dimensions such as engagement, motivation, and self-regulation. This is followed by qualitative data collection through structured interviews with a subset of participants, offering a deeper understanding of their interactions with the AI-integrated gamified formative assessment platform. The sequential design ensures that qualitative findings supplement and explain quantitative results, contributing to a nuanced interpretation of how this innovative approach impacts students' listening comprehension. The research design aligns with the study's objective of evaluating both the measurable effects and the subjective experiences of learners, reflecting the complex interplay between assessment methodologies, student engagement, and skill development in EFL listening instruction.

The participants in this study consisted of 38 first-semester students from Universitas PGRI Delta Sidoarjo, a private university in East Java, Indonesia. These students were enrolled in an English for General Purposes Course, which is a mandatory subject for non-English major undergraduates. The selection of first-semester students was intentional, as they are at an early stage of developing their listening comprehension skills in academic settings. The study's participants were chosen using purposive sampling to ensure that the sample included students with varying levels of English proficiency, reflecting the diverse linguistic backgrounds typical of non-English majors. In the quantitative phase, all 38 students participated in a closed-ended questionnaire designed to assess their engagement, motivation, and self-regulated learning strategies within the AI-integrated gamified formative assessment environment. For the qualitative phase, six students were selected for structured interviews based on their responses to the questionnaire, ensuring a range of perspectives from students who demonstrated differing levels of engagement and perceived effectiveness of the platform. This approach allowed for a more detailed examination of individual experiences and challenges faced during the learning process. The demographic profile of participants, including gender, age, and self-reported English proficiency levels, is presented in Table 1.

Table 1. Demographic Profile of Participants (n = 38)

Category	Subcategory	Frequency *(n)*	Percentage *(%)*
Gender	Male	16	42.1
	Female	22	57.9
Age *(Years)*	18 - 24	12	31.6
	25 - 34	21	55.3
	35+	5	13.1
English Proficiency *(Self-Reported)*	Beginner	28	73.7
	Intermediate	8	21.0
	Advanced	2	5.3

Instruments

The study employed a closed-ended questionnaire to quantitatively assess students' engagement, motivation, and self-regulation in the AI-integrated gamified formative assessment environment. The questionnaire was adapted from validated instruments previously utilized in digital learning engagement and self-regulation research (Slamet et al.,

2024a; Slamet & Basthomi, 2024) to ensure theoretical and empirical grounding. It consisted of 24 Likert-scale items, evenly distributed across three dimensions: engagement (8 items), motivation (8 items), and self-regulation (8 items). The engagement dimension measured students' active participation in gamified activities and their interaction with AI-driven feedback, while the motivation dimension evaluated their interest, intrinsic drive, and perceived usefulness of the AI-integrated platform. The self-regulation dimension assessed students' ability to plan, monitor, and adapt their listening comprehension strategies while using the platform. Each item was rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree).

To ensure the validity and reliability of the questionnaire, expert validation was conducted with three specialists in language assessment and educational technology. The experts provided feedback on content clarity, relevance, and alignment with the research objectives, leading to minor revisions in item wording to improve comprehensibility. In addition to the questionnaire, qualitative data were collected through structured interviews with six selected participants. The interview protocol focused on the students' perceptions of AI-generated feedback, their experiences with gamification elements, and the extent to which formative assessments influenced their listening comprehension. The interviews included open-ended questions designed to elicit detailed narratives, enabling a deeper understanding of learning behaviors within the platform. To ensure reliability and validity, the interview protocol was reviewed by the same panel of experts and revised based on their recommendations.

Data Collection Procedures

Data collection was conducted over one academic semester (14 weeks, two credits) within the AI-integrated gamified formative assessment platform, embedded in the English for General Purposes Course. The platform provided an interactive and structured learning environment where students engaged in diverse formative listening comprehension tasks, quizzes, and AI-driven feedback mechanisms. The primary medium of instruction was English, with no translation provided to ensure linguistic immersion. The students interacted with the platform for approximately 90 minutes per session in a week, engaging with various gamified activities that incorporated real-time AI feedback. The AI system analyzed students' listening comprehension performance and provided adaptive feedback, allowing learners to track their progress. The formative assessment framework was structured to reinforce listening skills progressively, integrating multimodal resources such as transcripts, audio

annotations, and interactive exercises. Students' participation, time spent on activities, and engagement with AI-generated feedback were systematically recorded to monitor learning behaviors. The course design and assessment activities are detailed in Table 2, outlining the formative assessment structure and AI integration features.

Table 2. Formative Assessment Features and Activities

Week	Activity Type	Assessment Features	Gamification Elements	AI Integration	Types of Questions & Number of Items
1-2	Diagnostic Listening Test	Initial assessment of students' listening proficiency	None	AI-generated feedback on strengths and weaknesses	Multiple-choice (10), Fill-in-the-blanks (5)
3-4	Interactive Listening Tasks	Short dialogues with comprehension checks	Points, badges	Adaptive difficulty based on student performance	Multiple-choice (8), True/False (5)
5-6	Real-time Quiz Challenges	Timed listening quizzes with instant feedback	Leaderboards, levels	AI-based speech recognition for spoken responses	Multiple-choice (10), Matching (5)
7-8	Annotation-Based Listening	Highlighting key information in transcripts	Progress tracking	AI-generated hints and personalized recommendations	Sentence completion (8), Fill-in-the-blanks (5)
9-10	Role-Based Scenario Tasks	Listening tasks within real-world simulated contexts	Story-based levels	AI-adaptive scenario adjustments based on learner choices	Multiple-choice (10), Short answer (5)
11-12	Peer Discussion & Reflection	AI-generated prompts for collaborative discussions	Collaborative badges	AI-moderated peer feedback and discussion analytics	Open-ended questions (8)
13-14	Summative Listening Project	Final project requiring critical analysis of listening input	Certificate awards	AI-generated performance analytics and feedback	Project-based, Open-ended responses

Data Analysis

Data analysis was conducted using both quantitative and qualitative approaches to provide a comprehensive understanding of how AI-integrated gamified formative assessment influenced listening comprehension. Quantitative data from the closed-ended questionnaire were analyzed using SPSS 27. Descriptive statistics were generated to determine means, standard deviations, and frequency distributions across the engagement, motivation, and self-regulation dimensions. Internal consistency was measured using Cronbach's alpha, yielding an overall reliability coefficient of 0.826, indicating a high level of reliability. Subscale reliability was also calculated, with engagement ($\alpha = 0.812$), motivation ($\alpha = 0.834$), and self-regulation ($\alpha = 0.821$) demonstrating strong internal consistency. For the qualitative phase, structured interviews were transcribed verbatim and subjected to thematic analysis following Braun and Clarke's (2006) six-phase framework. The transcriptions were first reviewed to identify initial codes, which were then grouped into broader themes reflecting students' perceptions of AI feedback, engagement with gamification, and the effectiveness of formative assessments. A second coding cycle refined these themes, ensuring a clear representation of students' experiences. To enhance reliability, inter-coder agreement was established through discussions among two independent researchers who reviewed and cross-checked coded transcripts.

Ethical Considerations

Ethical considerations were carefully observed throughout the research process. Ethical approval was obtained from the Ethics Committee of Universitas PGRI Delta Sidoarjo, ensuring that all procedures adhered to ethical guidelines for research involving human participants. Informed consent was obtained from all students before their participation, with assurances of anonymity and confidentiality in data handling. Participants were given the option to withdraw at any stage without consequences, and data security measures were implemented to protect personal information. Additionally, the AI-integrated platform complied with data privacy regulations, ensuring that student interactions and performance analytics were used solely for research and pedagogical purposes.

Results

The study aimed to investigate the influence of AI-integrated gamified formative assessment on listening comprehension development among non-English major undergraduate students. The findings were derived from a quantitative analysis of a closed-ended questionnaire and qualitative insights from structured interviews.

Table 3. Questionnaire Results *(n = 38)*

Dimension	No	Item	SD *(n, f)*	D *(n, f)*	N *(n, f)*	A *(n, f)*	SA *(n, f)*	Mean	Std. Dev
Engagement	1	I actively participated in gamified listening tasks.	1 (2.6%)	2 (5.3%)	3 (7.9%)	18 (47.4%)	14 (36.8%)	4.11	0.87
	2	I interacted with AI-generated feedback to improve listening.	0 (0%)	2 (5.3%)	4 (10.5%)	20 (52.6%)	12 (31.6%)	4.11	0.77
	3	I enjoyed earning points in the gamified assessments.	2 (5.3%)	3 (7.9%)	5 (13.2%)	15 (39.5%)	13 (34.2%)	3.89	0.99
	4	I found interactive quizzes helpful for comprehension.	1 (2.6%)	2 (5.3%)	2 (5.3%)	19 (50%)	14 (36.8%)	4.13	0.88
	5	I checked my progress using the AI-generated reports.	2 (5.3%)	3 (7.9%)	6 (15.8%)	18 (47.4%)	9 (23.7%)	3.76	1.00
	6	I engaged more in listening tasks due to gamification.	1 (2.6%)	4 (10.5%)	3 (7.9%)	21 (55.3%)	9 (23.7%)	3.87	0.94
	7	I preferred gamified assessments over traditional listening tests.	3 (7.9%)	3 (7.9%)	6 (15.8%)	15 (39.5%)	11 (28.9%)	3.74	1.10
	8	I focused more during tasks due to leaderboard rankings.	4 (10.5%)	5 (13.2%)	6 (15.8%)	13 (34.2%)	10 (26.3%)	3.53	1.19

Dimension	No	Item	SD (n, f)	D (n, f)	N (n, f)	A (n, f)	SA (n, f)	Mean	Std. Dev
Motivation	9	I felt motivated to complete all listening tasks.	1 (2.6%)	3 (7.9%)	4 (10.5%)	19 (50%)	11 (28.9%)	3.95	0.93
	10	I found the AI-generated feedback useful for improvement.	0 (0%)	2 (5.3%)	4 (10.5%)	22 (57.9%)	10 (26.3%)	4.05	0.79
	11	I was eager to engage in AI-integrated assessments.	1 (2.6%)	3 (7.9%)	5 (13.2%)	18 (47.4%)	11 (28.9%)	3.92	0.94
	12	I felt rewarded when I achieved high scores.	2 (5.3%)	3 (7.9%)	6 (15.8%)	16 (42.1%)	11 (28.9%)	3.82	1.03
	13	I challenged myself to improve through AI-driven tasks.	0 (0%)	3 (7.9%)	4 (10.5%)	22 (57.9%)	9 (23.7%)	3.97	0.85
	14	I preferred interactive AI-based assessments.	1 (2.6%)	4 (10.5%)	5 (13.2%)	18 (47.4%)	10 (26.3%)	3.84	0.97
	15	I found gamified learning enjoyable.	2 (5.3%)	3 (7.9%)	5 (13.2%)	19 (50%)	9 (23.7%)	3.79	1.01
	16	I felt confident when completing AI-based assessments.	2 (5.3%)	4 (10.5%)	6 (15.8%)	17 (44.7%)	9 (23.7%)	3.71	1.06
Self-Regulation	17	I planned my listening strategies before assessments.	1 (2.6%)	3 (7.9%)	5 (13.2%)	18 (47.4%)	11 (28.9%)	3.92	0.94

Dimension	No	Item	SD *(n, f)*	D *(n, f)*	N *(n, f)*	A *(n, f)*	SA *(n, f)*	Mean	Std. Dev
	18	I adjusted my learning strategies after AI feedback.	0 (0%)	2 (5.3%)	4 (10.5%)	22 (57.9%)	10 (26.3%)	4.05	0.79
	19	I monitored my listening progress through AI analytics.	2 (5.3%)	3 (7.9%)	6 (15.8%)	18 (47.4%)	9 (23.7%)	3.76	1.00
	20	I reviewed incorrect answers to improve my comprehension.	1 (2.6%)	3 (7.9%)	5 (13.2%)	19 (50%)	10 (26.3%)	3.89	0.93
	21	I set personal goals for my listening performance.	1 (2.6%)	4 (10.5%)	6 (15.8%)	18 (47.4%)	9 (23.7%)	3.79	0.99
	22	I self-evaluated my listening comprehension skills.	2 (5.3%)	3 (7.9%)	6 (15.8%)	17 (44.7%)	10 (26.3%)	3.76	1.03
	23	I practiced listening outside of class due to AI feedback.	3 (7.9%)	4 (10.5%)	5 (13.2%)	17 (44.7%)	9 (23.7%)	3.66	1.13
	24	I used AI feedback to refine my listening techniques.	0 (0%)	2 (5.3%)	4 (10.5%)	22 (57.9%)	10 (26.3%)	4.05	0.79

The questionnaire results provide valuable insights into the impact of AI-integrated gamified formative assessment on students' engagement, motivation, and self-regulation in listening comprehension. The engagement dimension revealed that the majority of students actively participated in gamified listening tasks (M = 4.11, SD = 0.87) and interacted with AI-generated feedback for improvement (M = 4.11, SD = 0.77). The leaderboard rankings

and gamified elements encouraged participation, with over 70% of students agreeing or strongly agreeing that they engaged more in listening tasks due to gamification (M = 3.87, SD = 0.94). However, some students expressed a neutral stance (15.8%) or disagreement (21.1%) on whether leaderboard rankings significantly influenced their focus (M = 3.53, SD = 1.19), indicating variability in responses to competitive game elements. The motivation dimension findings indicate that students were highly motivated to complete listening tasks (M = 3.95, SD = 0.93) and found AI-generated feedback useful for improvement (M = 4.05, SD = 0.79). A notable 84.2% of participants agreed that they challenged themselves to improve through AI-driven tasks (M = 3.97, SD = 0.85).

The sense of reward and achievement was also reflected in responses, as students reported feeling motivated when they earned high scores (M = 3.82, SD = 1.03). However, some students expressed mild uncertainty (13.2%) about whether gamified learning was preferable to traditional listening assessments (M = 3.74, SD = 1.10), suggesting that personal learning preferences may influence motivation levels. Regarding self-regulation, students demonstrated a strong inclination toward planning and adjusting learning strategies based on AI feedback. The highest-rated item in this category indicated that 84.2% of students adjusted their listening strategies after receiving AI feedback (M = 4.05, SD = 0.79). Students also monitored their listening progress using AI analytics (M = 3.76, SD = 1.00) and self-evaluated their listening comprehension skills (M = 3.76, SD = 1.03). However, a relatively lower mean score (M = 3.66, SD = 1.13) for practicing listening outside class due to AI feedback suggests that external factors such as time constraints or individual motivation may have influenced engagement beyond the structured course activities. These results suggest that the AI-integrated gamified formative assessment positively influenced student engagement, motivation, and self-regulation, though individual differences in response to gamification elements were evident.

To complement the quantitative findings, structured interviews were conducted with six selected students (P1–P6) to gain deeper insights into their experiences with AI-integrated gamified formative assessment in listening comprehension. The thematic analysis identified three primary themes: (1) Perceptions of AI-Generated Feedback, (2) Impact of Gamification Elements on Learning, and (3) Challenges in AI-Integrated Listening Assessments.

a. Theme 1: Perceptions of AI-Generated Feedback

Students generally perceived AI-generated feedback as beneficial in helping them identify errors, refine listening strategies, and track progress. However, some participants noted that AI feedback was occasionally too general or insufficient in explaining complex listening errors.

Interview Question: How did AI-generated feedback impact your listening comprehension skills?

Table 4. Coding for Perceptions of AI-Generated Feedback

Coding	Description	Quotes (P1–P6)
Immediate error identification	AI feedback provided real-time correction, allowing students to quickly recognize mistakes and improve.	**P1:** *"The feedback was immediate, so I could understand my mistakes right away. It helped me recognize words I misheard and improve faster."*
Enhanced listening focus	AI feedback helped students focus on specific listening aspects such as stress and intonation.	**P3:** *"Sometimes I didn't realize my errors until I saw the AI feedback. It helped me focus on specific aspects of listening, like stress and intonation."*
Tracking learning progress	AI analytics allowed students to monitor progress and adjust learning strategies accordingly.	**P6:** *"The AI provided explanations and suggestions, which I found useful. I used it to track my progress and adjust my strategies."*
Lack of detailed explanations	Some students felt that AI feedback lacked depth, especially for complex listening errors.	**P4:** *"The feedback was helpful but sometimes too general. I wish it could give more detailed explanations about why I misinterpreted certain phrases."*
Preference for human feedback	AI feedback was effective for basic errors, but some students preferred teacher explanations for more challenging tasks.	**P5:** *"It was good for simple mistakes, but for difficult listening parts, I still needed help from my teacher."*
Over-reliance on AI feedback	Some students became too dependent on AI-generated corrections instead of developing independent listening strategies.	**P2:** *"I relied a lot on the AI feedback. Sometimes I felt like I wasn't really improving on my own."*

The findings indicate that AI-generated feedback was instrumental in enhancing students' listening comprehension skills by providing immediate correction and allowing self-monitoring of progress. The ability to recognize misheard words and adjust listening strategies was frequently highlighted as a strength of the AI system. However, some students found the feedback insufficient for more complex errors, preferring teacher explanations in such cases. Additionally, some participants expressed concern about becoming too reliant on

AI-generated corrections. This suggests that while AI feedback can effectively support learning, a hybrid approach integrating both AI and instructor-led guidance may be necessary to address more nuanced listening difficulties.

b. Theme 2: Impact of Gamification Elements on Learning

Students generally responded positively to gamification elements such as leaderboards, points, and progress tracking. These elements enhanced motivation and engagement by fostering a sense of achievement and competition. However, some students expressed indifference toward competitive aspects, while others found certain gamified rewards frustrating when they failed to achieve the desired progress.

Interview Question: How did gamification elements influence your learning experience?

Table 5. Coding for the Impact of Gamification Elements on Learning

Coding	Description	Quotes (P1–P6)
Increased motivation through competition	Leaderboards encouraged students to challenge themselves and improve their performance.	**P2:** *"I liked the leaderboard. It made me want to try harder and see my name in the top rankings."*
Gamified rewards encouraged focus	Earning points motivated students to concentrate on tasks and complete exercises.	**P3:** *"The points system was fun. I wanted to collect as many as possible, so I focused more on the tasks."*
Sense of achievement through progress tracking	Badges and rewards reinforced students' sense of accomplishment.	**P5:** *"The badges were a great reward. It felt like an achievement every time I completed a difficult task."*
Indifference toward competitive elements	Some students were uninterested in rankings, prioritizing personal learning progress instead.	**P6:** *"I didn't care much about leaderboards. I just wanted to learn and improve, so rankings didn't matter to me."*
Frustration with gamified progress tracking	Some students felt demotivated when unable to earn expected rewards.	**P4:** *"I liked the badges, but sometimes I felt frustrated when I didn't earn them. It made me feel like I wasn't progressing fast enough."*
Overemphasis on competition	The focus on competition sometimes overshadowed the learning process.	**P1:** *"I felt more stressed about collecting points than actually learning. It made me focus on winning rather than improving my listening."*

The findings suggest that gamification elements generally enhanced motivation and engagement, with students responding positively to rewards, leaderboards, and progress tracking. Many participants reported that these elements encouraged them to invest more effort in listening tasks. However, some students felt indifferent toward competitive features, indicating that motivation levels varied depending on individual preferences. Additionally, a few participants noted that the emphasis on competition sometimes created unnecessary pressure. These results highlight the need for a balanced gamification approach that encourages learning engagement without inducing stress or discouragement.

c. Theme 3: Challenges in AI-Integrated Listening Assessments

Despite the benefits, some challenges were reported regarding AI-integrated assessments. Students mentioned technical issues, difficulty adapting to AI-generated questions, and occasional misinterpretations by the AI system.

Interview Question: What challenges did you face when using AI-integrated assessments?

Table 6. Coding for Challenges in AI-Integrated Listening Assessments

Coding	Description	Quotes (P1–P6)
Technical issues affecting assessments	AI system delays or internet problems sometimes disrupt the assessment process.	**P6:** *"If my internet connection was slow, the system took longer to load, which was annoying."*
Misinterpretation of student responses	The AI occasionally failed to recognize correct answers, leading to frustration.	**P1:** *"Sometimes the AI didn't understand my answer even when I said the right thing. It was frustrating."*
Difficulty with AI-generated questions	Some students found AI-formulated questions challenging or unnatural.	**P4:** *"The system worked well most of the time, but sometimes I felt like the questions were too difficult."*
Limited AI adaptability to varied responses	AI lacked flexibility in evaluating alternative correct answers.	**P3:** *"I noticed that if I didn't phrase my answer exactly the way the AI expected, it marked it wrong."*
Need for additional human support	Some students needed teacher intervention to clarify assessment errors.	**P2:** *"When I got something wrong, I sometimes wished I could ask my teacher, not just rely on AI."*
AI-driven assessments felt impersonal	Some students preferred human assessment over AI-driven feedback.	**P5:** *"AI was useful, but I still prefer getting feedback from a real person who understands how I think."*

While AI-integrated listening assessments provided benefits such as instant feedback and adaptive testing, they also posed challenges, particularly in cases where AI misinterpreted responses. Technical difficulties further contributed to frustration, and some students expressed a need for human intervention in complex assessments. These findings indicate that AI-based assessments should be complemented with human support to ensure clarity, fairness, and a more personalized learning experience.

The findings from both the quantitative and qualitative analyses highlight the effectiveness of AI-integrated gamified formative assessment in enhancing students' listening comprehension skills, motivation, and engagement. AI-generated feedback was particularly beneficial in providing immediate error correction and enabling self-monitoring, though some students expressed concerns about its limitations in explaining complex mistakes. Gamification elements, such as leaderboards, points, and badges, significantly boosted motivation, yet individual preferences varied, with some students experiencing frustration due to competitive pressures. Despite the overall positive reception, challenges such as technical issues, AI misinterpretations, and the need for additional human support in assessments were evident. These results underscore the importance of a balanced approach that integrates AI-driven features with human instruction, ensuring both engagement and pedagogical effectiveness while mitigating potential drawbacks. Future implementations should focus on refining AI feedback mechanisms, enhancing the adaptability of AI-generated assessments, and providing supplementary teacher support to maximize learning outcomes.

Discussion

The findings of this study reveal that AI-integrated gamified formative assessment significantly enhances students' engagement, motivation, and self-regulated learning in listening comprehension. These results align with previous studies emphasizing the potential of AI-driven feedback and gamification to foster active learning (Hutson et al., 2024; Qiao & Zhao, 2023). AI-generated feedback provided students with immediate and personalized guidance, reinforcing previous research highlighting the role of real-time corrective feedback in improving listening accuracy and comprehension strategies (Alimorad & Saleki, 2022; Yang et al., 2022). However, while the feedback proved effective for identifying misheard words and refining listening strategies, some students perceived it as insufficiently detailed in addressing complex comprehension difficulties. This result echoes concerns in earlier studies that AI feedback, though immediate, often lacks the depth of human explanations, leading to

potential misunderstandings in nuanced listening tasks (Ngo, 2019; Rukthong, 2021). Thus, while AI-generated feedback enhances self-monitoring, its limitations indicate the need for hybrid feedback mechanisms that integrate AI precision with human instructional support.

Gamification elements embedded within the AI-integrated assessment further reinforced student motivation and engagement. Consistent with prior research, game-based features such as leaderboards, points, and badges increased learners' willingness to participate in listening tasks and fostered a sense of achievement (Slamet & Mukminatien, 2024; Yaniafari et al., 2020). The present study confirms findings from Pérez-Segura et al. (2022), who reported that competition-driven gamification enhances motivation, particularly among students with high achievement orientation. However, as observed in this study, not all students responded positively to competitive elements, as some felt pressured or discouraged by their ranking positions. This finding aligns with research by Romsi et al. (2024) and Slamet and Basthomi (2024), which cautioned that while gamification fosters engagement, excessive competition can create anxiety and diminish intrinsic motivation for learners who prioritize mastery over performance. These insights suggest that a more personalized gamification approach, incorporating adaptive challenges and self-paced rewards, may better cater to diverse learner preferences.

Furthermore, this study highlights the role of AI-integrated gamified assessment in supporting self-regulated learning, particularly in planning, monitoring, and adjusting listening strategies. This is consistent with previous studies demonstrating that AI-enhanced platforms encourage students to take ownership of their learning through personalized scaffolding and real-time progress tracking (Slamet, 2024; Villarino, 2025). The gamified AI system allowed students to self-assess their progress and refine their listening skills based on AI feedback, supporting findings from Parveen and Alkudsi (2024), who argued that gamification and AI-driven adaptability strengthen metacognitive skills in language learning. However, some students in the present study encountered challenges with AI misinterpretation of responses, mirroring concerns raised in prior research regarding the accuracy of automated listening assessments (Ngo, 2019). Such issues reinforce the argument that AI models, while sophisticated, still struggle with processing linguistic variations, accents, and contextual inferences in spoken language (Yaniafari et al., 2020). These findings suggest that while AI-driven assessment fosters self-regulated learning, its effectiveness could be further improved by integrating human intervention to refine feedback accuracy.

Despite the overall benefits of AI-driven gamification, this study also identified technical and pedagogical challenges that require attention. Students reported occasional

system errors, slow responses, and internet connectivity issues, which disrupted their engagement, consistent with previous studies indicating that digital learning platforms are often constrained by technological limitations (Slamet et al., 2024b). Additionally, while AI-generated feedback enhanced immediate comprehension, it lacked adaptability in handling ambiguous listening errors, corroborating findings by Qiao and Zhao (2023) that AI-based assessments struggle with deep cognitive processing in language learning. This limitation suggests that future AI-integrated assessments should incorporate more advanced natural language processing and adaptive learning algorithms to better support learners' diverse comprehension needs.

Taken together, the findings of this study contribute to the growing body of literature on AI-integrated gamified assessment in EFL listening comprehension by addressing critical gaps identified in previous research. While prior studies have explored AI-driven feedback and gamification separately, this study provides empirical evidence on their combined impact, demonstrating that AI and gamification can work synergistically to enhance engagement, motivation, and self-regulation. However, it also reveals that AI's limitations in interpretive accuracy and gamification's varied motivational impact necessitate a more balanced and adaptive instructional design. Future implementations should focus on refining AI-driven feedback, offering a wider range of gamified incentives beyond competition-based elements, and incorporating human mediation to address AI-related challenges. These insights underscore the need for a pedagogical framework that optimally integrates AI's analytical capabilities with the nuanced instructional support of educators, ensuring that technology-enhanced formative assessment is both effective and inclusive in diverse EFL learning contexts.

Conclusion

The findings of this study underscore the transformative potential of AI-integrated gamified formative assessment in enhancing engagement, motivation, and self-regulated learning in listening comprehension. The integration of AI-generated feedback enabled students to receive immediate and personalized guidance, allowing them to refine their listening strategies and monitor their progress. Gamification elements further contributed to an interactive learning experience, fostering a sense of achievement and sustained participation. However, while AI-driven assessment and game-based features proved beneficial, variations in student responses highlight the complexity of individual learning preferences. While some learners thrived in a competitive environment, others experienced anxiety or frustration when

rewards and rankings did not align with their expectations. Similarly, while AI-generated feedback effectively addresses surface-level listening errors, its limitations in handling complex linguistic nuances suggest the need for human mediation to enhance interpretive accuracy. These insights hold important implications for instructional design, emphasizing the need for adaptive gamification models that cater to diverse motivational drivers and AI systems that incorporate deeper linguistic processing for more nuanced feedback.

Additionally, technological constraints, including system errors and internet dependency, indicate that infrastructure readiness must be considered in AI-based implementations. The study's findings suggest that future developments should focus on hybrid feedback models, where AI-generated insights are complemented by human intervention to enhance pedagogical effectiveness. A more personalized gamification approach, integrating adaptive challenges and self-paced rewards, may further optimize learner engagement. While this study contributes valuable empirical evidence, its findings are limited by sample size and contextual specificity, warranting further research across diverse EFL settings. Longitudinal investigations could also provide deeper insights into the long-term effects of AI-integrated gamified assessment on listening skill development. These considerations highlight the necessity for continuous refinement in AI-enhanced language learning frameworks to ensure both effectiveness and inclusivity in diverse educational contexts.

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Declaration of Conflicting Interests

The authors declare no conflicts of interest pertaining to this study.

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