LALEj

LANGUAGE AND LITERACY EDUCATION JOURNAL

1(1) (2025)

30 - 47

PERSONALIZED BLENDED LEARNING THROUGH AI AND GAMIFICATION: ENHANCING PRIMARY STUDENTS' LANGUAGE AND LITERACY IN GUANGDONG, CHINA

***Zihe Wu[1], Huzaina Abdul Halim[1], & Mohd Rashid Mohd Saad[1]**

[1]Department of Language and Literacy Education, Faculty of Education, Universiti Malaya

****s2189469@siswa.um.edu.my***

ABSTRACT

This empirical study addresses the urgent need for more effective, engaging approaches to language and literacy education in primary schools by integrating artificial intelligence (AI) and gamification within a blended learning environment. Although prior research has examined the benefits of AI and gamification, little is known about their combined impact on young learners in linguistically diverse regions such as Guangdong Province, China. The study employed a quasi-experimental design involving 200 students aged 6 to 12, evenly distributed by gender into experimental and control groups. The experimental group received instruction through AI-enhanced personalized learning pathways and gamified tasks, while the control group followed traditional teaching methods. Data were collected through standardized reading tests, vocabulary assessments, and validated instruments measuring motivation and engagement. Results revealed that the experimental group significantly outperformed the control group, demonstrating a 25% increase in vocabulary acquisition, a 30% gain in reading comprehension, a 20% rise in engagement, and a 15% improvement in motivation. These findings underscore the effectiveness of combining AI and gamification in promoting individualized, motivating, and data-driven learning experiences. The study offers practical implications for educators and school leaders seeking to enhance language education through adaptive technologies and game-based strategies, and it opens new avenues for research on the long-term impact and scalability of these innovations.

Keywords: *Classroom blended learning, artificial intelligence, gamification, language education, literacy skills.*

INTRODUCTION

Blended learning is the integration of online learning with traditional in-person training. The beneficial effects of this method on learning and teaching results are acknowledged (AlManafi et al., 2023; Alrajaby, 2024; Mohebbi et al., 2023; Pino, 2024; Wulandari, 2023). Blended learning approaches,

which improve student engagement and performance, result from integrating technology into education (Nida, 2023; Schweiker, 2023). The changing nature of education highlights the need for balanced models incorporating traditional and online approaches (Alrajaby, 2024). An effective method in contemporary education is combining synchronous and asynchronous learning with visualization techniques and various media (Leng, 2023; Schweiker, 2023). By integrating cutting-edge technologies with conventional teaching techniques, blended learning—especially useful in language and literacy education— improves student outcomes (Eugenijus, 2023; Komari, 2023; Rabbi, 2024; Scullin, 2024). Blended learning is a flexible learning environment that accommodates a range of learning styles through the use of interactive technologies, multimedia, and internet resources (Scullin, 2024; Wang, 2024). This strategy creates a dynamic, interactive environment supporting literacy and language development (Mastika, 2023; Xu, 2024). According to Eugenijus (2023), Komari (2023), and Xu (2024), blended learning fosters digital literacy, strengthens multidisciplinary abilities, and aids in the development of linguistic proficiency. Blended learning maximizes language and literacy outcomes as the educational landscape changes to individualized, data-driven approaches (Wang, 2024; Xu, 2024).

In today's classroom, artificial intelligence (AI) and gamification are becoming more and more crucial for individualized instruction and increased student engagement. AI enhances customization using algorithms like neural networks and deep learning to tailor learning experiences (Nurjanah, 2024). Gamification leverages game features to increase motivation and engagement by offering rewards like points and leaderboards to promote participation (Puspitasari, 2023; Polat, 2023). While gamification produces a dynamic environment that encourages active engagement, AI in adaptive platforms personalizes learning (Suwandani, 2024; Thuan, 2024). Teachers can develop effective, student-centered settings that accommodate a variety of learning styles by combining AI for tailored learning with gamification for engagement. The integration of AI and gamification in education has the potential to improve established practices. AI systems can support learning, offer individualized feedback, and assist educators in assessing student development (Akavova, 2023; Pendy, 2023). Gamification improves motivation and engagement by introducing game aspects into learning environments (Hellín, 2023; Lyons et al., 2023; McNeill, 2024). Educators may design dynamic, interactive experiences that meet the needs of each student by utilizing gamification to increase engagement and AI to personalize learning (Chen, 2024; Setyoadi, 2024). These tools have the potential to completely change education by encouraging interactive, collaborative learning and developing critical thinking, creativity, and flexibility (Bhat, 2023; Rabbi, 2024). The integration of AI with gamification has the potential to improve educational outcomes and transform teaching approaches into ones that are more dynamic and efficient.

Guangdong Province in China offers a distinctive educational environment where proficiency in language and reading are essential for success due to the province's diversified population and rapid growth. Guangdong, a trade and cultural interchange center, has difficulties overcoming linguistic divides and raising the literacy rate of young students. Technology integration is becoming increasingly important in local programs to enhance learning outcomes. This study examines the efficacy of AI and gamification in blended learning, emphasizing Guangdong, to improve language acquisition and literacy in this dynamic situation.

PROBLEM STATEMENT

The effects of AI, gamification, and blended learning in language education have been well-studied in the literature. These effects are especially beneficial for student motivation, engagement, and learning outcomes (Alenezi, 2023; Hersi, 2024; Kherazi, 2024; Zhang & Hasim, 2023). However, the literature on the combined effects of AI and gamification in Guangdong Province's language and literacy education lacks specifics. This is especially true regarding how combining these technologies can improve learning outcomes in an area where Cantonese and Mandarin dynamics may impact academic performance (Huang, 2024). Future research can investigate how integrating AI and gamification can address language learning challenges in Guangdong Province, as there are few empirical studies on the synergistic effects of AI-driven personalized learning and gamified language

instruction in this context.

It is imperative to fill the knowledge gap on the synergistic effects of AI and gamification in Guangdong Province's language and literacy education for several reasons. Initially, gaining knowledge about how AI and gamification can improve blended learning results in a diverse and dynamic learning environment such as Guangdong Province could result in more efficient and interesting teaching approaches that are customized to the individual needs of students (Alenezi, 2023; Babu, 2023; Kherazi, 2024). Second, by investigating the potential synergies between gamified language education and AI-driven tailored learning, educators may be able to better support language acquisition and literacy development in situations where language dynamics may impact academic performance (Abdullah, 2023). This study may offer important new perspectives on best supporting language acquisition, raising student enthusiasm and involvement, and eventually improving educational results in Guangdong Province and beyond.

RESEARCH OBJECTIVES AND QUESTIONS

This study assesses how well gamification and AI-enhanced blended learning environments can improve language acquisition and literacy abilities in Guangdong Province's primary school students. The following questions guide this research: (1) how does AI affect language learning and student engagement in a blended learning setting? (2) how does gamification affect the literacy and motivation of students? (3) how does the educational outcome compare gamification and AI to traditional teaching methods?

SIGNIFICANCE OF THE STUDY

The present study adds a noteworthy piece to the expanding body of literature on blended learning by investigating the joint impacts of gamification and AI in this context. Although these components have been the subject of separate studies in the past, this study integrates them innovatively. It empirically supports their combined influence on literacy and language acquisition in elementary education. These findings improve our understanding of combining gamification and AI-powered individualized learning paths to build more effective and interesting learning environments. Moreover, this study can be a basis for later research on these technologies' scalability and long-term impacts in various educational contexts.

This study's ability to influence and change educational methods in Guangdong Province and elsewhere makes it practically significant. The findings provide useful information for educators about how to incorporate gamification and AI successfully into blended learning to improve academic performance and student engagement. School administrators can use these results to create more individualized, technologically enhanced curricula that meet the various needs of their students. To ensure that schools are prepared to integrate these advances successfully, policymakers can also utilize this study to direct investments in professional development and instructional technology. In the end, this study favors the more general objective of using technology to improve the caliber and accessibility of education.

LITERATURE REVIEW

Theoretical Framework

Constructivist Learning Theory. The Constructivist Learning Theory emphasizes learning as an active and constructive process by proposing that learners actively generate knowledge through interactions with their surroundings (Li, 2022). According to the notion, students develop their understanding of the world by interacting with it and forming knowledge through experiences, introspection, and interpersonal relationships. Learners develop their conceptual understanding through active engagement in activities, debates, and problem-solving. This method highlights the value of practical experience, teamwork, and critical thinking while highlighting that knowledge is

actively created rather than passively absorbed. Learning settings that are focused on the needs of the individual student and encourage experimentation, discovery, and the development of lifelong learning abilities are supported by constructivist learning theory (Alenezi, 2023; Huang & Lee, 2022; Mulyatiningsih et al., 2023). It emphasizes student participation in constructing knowledge through interaction with digital content and in-person education, which aligns with blended learning. With this method, students can interact with AI-tailored content, study at their own pace, and critically evaluate the individualized learning experiences they have created. Blended learning reinforces constructivist ideas using digital resources and conventional teaching techniques by allowing students to actively build knowledge from their experiences (Matthews, 2024; Sulindra, 2024).

Adaptive Learning Theory. With AI technology being well-suited for constructing tailored learning pathways, Adaptive Learning Theory centers on customizing educational experiences to meet the needs of individual learners. Through AI algorithms, educational platforms may provide personalized learning experiences by analyzing students' learning preferences, habits, and performance data. By customizing content, tempo, and teaching style to meet the individual needs of each learner, this personalized method improves motivation, engagement, and retention of knowledge (Naseer, 2024). Enhancing this process by incorporating deep learning techniques enables the development of customized learning paths that address each student's strengths and limitations, resulting in better learning results (Naseer, 2024). AI-powered adaptive learning systems provide a dynamic, adaptable learning environment that maximizes students' learning potential and promotes academic success. The study uses AI-powered adaptive learning to modify task complexity and tempo in response to students' performance to optimize learning. The adaptive learning system evaluates students' responses and progress to continuously adjust the content to each student's learning preferences and skill level using AI algorithms (Dabingaya, 2022). Tasks that are too simple or challenging might cause boredom or irritation in pupils, but our individualized technique guarantees that they are continually pushed at an appropriate level. According to Dabingaya (2022), the adaptable nature of the system enables prompt modifications, offering tailored assistance and guidance to improve comprehension and abilities. By providing individualized experiences, this adaptive learning method maximizes learning objectives and promotes ongoing academic progress.

Gamification Theory. With the help of essential components like points, badges, leaderboards, and challenges, Gamification Theory incorporates game-design aspects into non-gaming environments to inspire and engage users. According to Rahmadhan et al. (2023), these components push users to complete tasks and reach goals by raising engagement and improving satisfaction. Chakra (2023) states that gamification tactics are typically designed using the MDA framework, which consists of mechanics, dynamics, and aesthetics. In gamified learning environments, it is essential to incorporate gamification with course objectives, offers immediate feedback, delineate clear guidelines, promote collaboration, and set challenging objectives (Wang, 2024).

Gamification components like challenges, leaderboards, badges, and points are essential for promoting involvement, engagement, and task completion in various settings. In language and literacy education, gamification has been shown to significantly increase student motivation and engagement. Gamification creates interactive and interesting learning experiences by integrating leaderboards, challenges, badges, points, and more (Kherazi, 2024). According to research, gamification substantially and positively impacts student engagement and pleasure in higher education, underscoring its potential to raise educational standards (Neerupa, 2024). Gamification in language education has many benefits, and one such benefit is that it can increase motivation and engagement when playful processes are applied in non-playful circumstances (Kherazi, 2024). Personalized, interactive experiences for mobile applications with AI-assisted gamification present a promising method for improving language acquisition (Kherazi, 2024). In language and literacy instruction, these results validate the effectiveness of gamification in fostering motivation, engagement, and learning outcomes.

Review of Empirical Studies

Blended Learning in Education. Numerous studies conducted in various educational settings have demonstrated the efficacy of blended learning, combining in-person and online learning to improve student results. Meta-analyses comparing blended and traditional learning outcomes were carried out by Yu et al. (2022), and the results showed favorable effects on student attitudes and performance. Fionasari (2024) highlighted blended learning methodologies' adaptability and usefulness in learning environments. Ruan (2024) demonstrated the advantages of blended learning for particular academic talents while concentrating on improving English writing skills. When taken as a whole, these studies highlight how blended learning enhances engagement, performance, and overall educational success by combining traditional and online techniques to maximize student learning. Regarding the long-term impacts of blended learning on language and literacy abilities in primary education, there is still a gap in the evidence, particularly in non-Western contexts like primary schools in Guangdong Province, China.

AI in Education. The application of AI in education has been the subject of empirical research, with a particular emphasis on improving student results and developing individualized learning experiences. A meta-analysis by Wu and Yu (2023) emphasized the beneficial effects of AI chatbots on students' learning outcomes and how well they complement learning. The growth of AI in education toward empowering students and personalizing the learning process was highlighted by Tapalova and Zhiyenbayeva (2022). They provided examples of how AI systems may adjust to the demands of specific students and design individualized, data-driven learning pathways. In his investigation of AI tools in educational measurement and evaluation, Owan (2023) showed how these technologies can evaluate student answers and offer tailored feedback, assisting students in identifying their areas of strength and weakness. In his investigation into the use of AI in physics education, Mustofa (2024) demonstrated how these technologies may be used to personalize instruction and provide customized feedback, which improves students' comprehension and mastery of difficult subjects. All of this research points to the effectiveness of AI in education, especially when it comes to developing individualized learning programs that meet the needs of each student. Nonetheless, more research is required to determine how AI will affect language and literacy instruction, particularly in blended learning environments. This study examines how AI-powered individualized learning paths can improve primary school students' literacy and language development to fill this knowledge gap.

Gamification in Education. In various learning environments, gamification has improved student motivation and engagement. Research indicates that implementing gamification tactics can enhance students' drive, independence, self-control, and general involvement with the subject matter (ArufeGiráldez et al., 2022). Moreover, gamification has improved learning results by raising interest and encouraging active engagement (Puspitasari, 2023; Suwandani, 2024). Gamification reduces learner distraction and encourages engagement in difficult subjects by introducing game design elements into non-gaming activities (Khaldi et al., 2023). Gamification is useful for increasing student engagement and enjoyment in low-resource settings using interactive gaming experiences and incentive systems (Asanza, 2024). Research indicates that gamification can improve learning outcomes by increasing student motivation and engagement, especially in disciplines that are thought to be harder or less interesting. This study investigates how to incorporate gamification successfully into blended learning environments to improve primary school reading outcomes and student motivation.

Conceptual Framework

This study is grounded in three interrelated theoretical perspectives—Constructivist Learning Theory, Adaptive Learning Theory, and Gamification Theory—which together inform the design and expected outcomes of the blended learning intervention. Based on these theoretical foundations, the conceptual framework in Figure 1 outlines how integrating AI and Gamification within a Blended Learning Environment is hypothesized to influence key cognitive and affective learning outcomes: motivation, engagement, vocabulary acquisition, and reading comprehension.

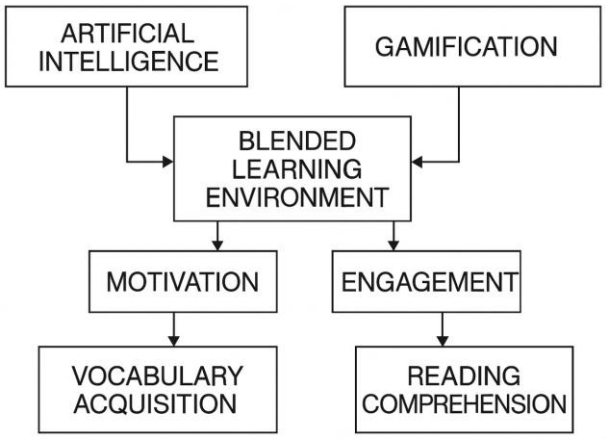
In this model, AI-enhanced personalized learning pathways function as the first core independent variable, aligned with Adaptive Learning Theory (Dabingaya, 2022; Naseer, 2024). Through real-time data analysis and tailored feedback, AI is expected to promote deeper content interaction and increase engagement and vocabulary learning.

Simultaneously, Gamification elements (e.g., points, badges, leaderboards, challenges) are introduced as the second independent variable, underpinned by the Mechanics–Dynamics–Aesthetics (MDA) framework from Gamification Theory (Kherazi, 2024; Rahmadhan et al., 2023). These features aim to boost learners' intrinsic motivation and emotional investment, which are hypothesized to affect engagement and reading comprehension indirectly.

Blended Learning acts as the contextual platform that enables the interaction of AI and gamification in both synchronous and asynchronous modalities. From a constructivist perspective, it provides opportunities for learners to actively construct knowledge, interact socially, and reflect critically—especially in tasks requiring vocabulary expansion and comprehension strategies (Li, 2022; Sulindra, 2024).

Collectively, this framework proposes both direct and indirect effects of AI and gamification on the four key dependent variables. Engagement and motivation are intermediate outcomes and mediators that enhance vocabulary learning and comprehension.

Figure 1.
Conceptual Framework

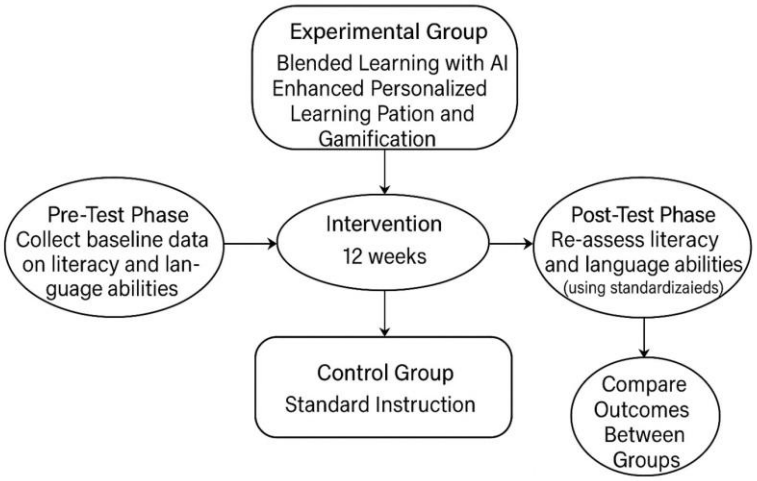


METHODOLOGY

Research Design

A quasi-experimental approach was employed in this study to evaluate the impact of gamified, AI-enhanced blended learning on primary school students' literacy and language development in Guangdong Province, China. Since the quasi-experimental approach closely mimics real-world classroom conditions while preserving a rigorous foundation for comparison, it was chosen instead of random student assignment due to practical restrictions prohibiting it. The study's pre-test, intervention, and post-test stages were carried out, as indicated in Figure 2. Standardized exams were utilized in the pre-test phase to gather baseline data on the literacy and language abilities of the children. Personalized learning paths, gamification, and AI-enhanced blended learning were provided to the experimental group throughout the intervention phase, while the control group continued to receive standard instruction. Student engagement with the new learning resources was guaranteed by the 12-week intervention. In the post-test phase, identical standardized exams were administered to both groups to gauge their respective gains in literacy and language competency. The architecture of this study permits a comparison of the two groups' results, facilitating a thorough assessment of the influence of gamification and AI in blended learning settings. By reflecting on the intricacies and dynamics of actual educational contexts, this method improves the ecological validity of the results.

Figure 2.
Research Design



Participants

Participants were chosen by deliberate sampling to guarantee a range of educational backgrounds and language ability levels. The sample was equally divided by gender, with 100 male and 100 female students, to ensure fair representation in the experimental and control groups. The experimental group engaged in a blended learning environment enriched by AI-powered individualized learning paths and gamification, and the control group, which got normal in-person instruction without digital enhancements, was randomly assigned to the student body. This split ensured that the groups could be compared, giving a solid foundation for assessing how the intervention affected the participants' literacy and language development. For the study results to be applied to a larger educational setting, the backgrounds of the individuals in the groups need to be diverse and well-balanced.

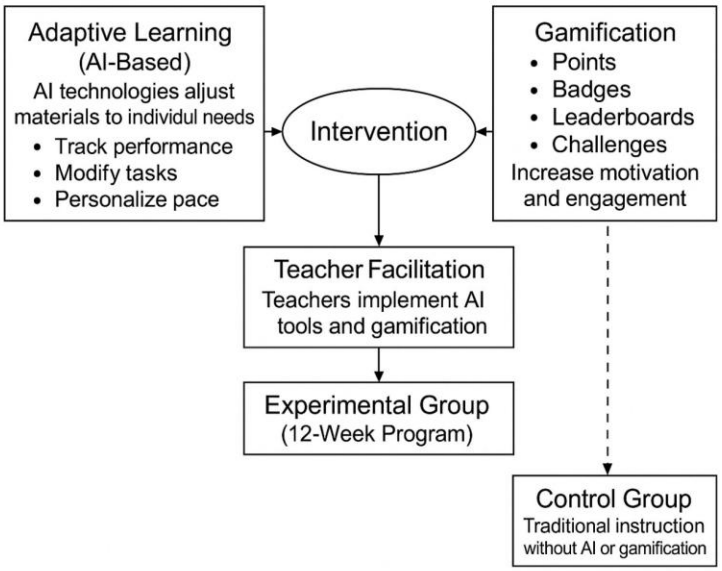
Intervention

As illustrated in Figure 3, the experimental group was given an intervention that included gamification components and AI-powered tailored learning pathways in a blended learning environment. The purpose of AI technologies is to customize educational materials to meet the unique learning requirements of every student. These systems tracked student performance, modifying task complexity and pace according to each learner's development. For example, students who excelled in a particular language skill set were automatically assigned more advanced material, while those who struggled were given more practice at a suitable difficulty level. Thanks to this adaptive method, every student had a personalized learning experience to help them reach their full potential.

Gamification components were incorporated into activities in addition to tailored learning routes to increase student motivation and engagement. Some of these components were points, badges, leaderboards, and interactive challenges. Students received points and badges as they completed assignments, participated in class discussions, and met learning objectives. Leaderboards encouraged students to compete with one another and actively participate in the material to move up the rankings. Students were prompted to collaborate to solve difficulties and accomplish shared objectives through interactive challenges, reinforcing important concepts and promoting collaborative learning.

Teachers were key players in the 12-week intervention, helping to make AI tools and gamification features in the classroom a reality. To ensure seamless adoption, teachers received instruction on how to use these technologies in their lessons efficiently. It is possible to compare the two strategies since the control group stuck to traditional face-to-face training without the use of AI or gamification.

Figure 3.
Intervention Process



Data Collection Methods

Surveys and results from standardized tests were combined for this study's data collection, which was done carefully to yield a thorough understanding of how well gamification and AI work in blended learning settings. Both the experimental and control groups received surveys to gauge the level of motivation, engagement, and impressions of the learning process among the students. The surveys contained questions modified from Appleton et al.(2006) Student Engagement Instrument (SEI), a well-known instrument for gauging emotional and cognitive involvement in learning environments.

With Cronbach's alpha values usually above 0.80, the SEI has exhibited strong internal consistency and has proven to be a reliable tool for assessing several facets of student engagement.

Furthermore, the effect of gamification on student motivation was measured using the Intrinsic Motivation Inventory (IMI) (Deci & Ryan, 2000), a multidimensional tool that evaluates students' interest, perceived competence, and value associated with the activity. With Cronbach's alpha values ranging from 0.70 to 0.85 across multiple subscales, the IMI also demonstrates good reliability and consistency in evaluating intrinsic motivation. These established instruments consistently measured students' psychological and behavioral reactions to the learning interventions, guaranteeing a solid and reliable data set.

Standardized tests assessed literacy and language acquisition gains, emphasizing reading comprehension and vocabulary development. The main evaluation instruments for receptive vocabulary and reading comprehension were the Gates-MacGinitie Reading Tests (GMRT) (MacGinitie et al., 2000) and the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn, 2007). The PPVT and GMRT are widely recognized in educational research due to their strong reliability, as seen by test-retest coefficients that are consistently above 0.90. This indicates that students' language proficiency and literacy skills are consistently assessed. The PPVT's efficacy in assessing receptive vocabulary has also been confirmed by its good validity and significant correlations to other standardized language exams. Like other literacy tests, the GMRT has high relationships with other measures, proving its validity as a reading comprehension measure.

All things considered, the study's instruments—the SEI, IMI, PPVT, and GMRT—show excellent reliability and validity, guaranteeing that the information gathered is reliable, consistent, and representative of the targeted constructs. These characteristics are essential for making intelligible judgments regarding how well gamification and AI can improve student motivation, engagement, and

literacy in blended learning environments.

Data Analysis

A comprehensive analysis of the study issues was ensured using a quantitative approach to assess data gathered from surveys and standardized tests. The results of standardized tests for vocabulary acquisition and reading comprehension and survey data on student motivation and engagement were compiled using descriptive statistics. The mean scores, standard deviations, and percentage changes gave an overview of the patterns in the experimental and control groups. This preliminary investigation proved that the gamified, AI-enhanced blended learning environment is generally effective. Pearson's coefficient of correlation examined the connections among important variables. The study examined the relationships between gamification components, AI-powered individualized learning pathways, and outcomes like academic achievement, motivation, and student engagement. Finding these connections sheds light on how these technological innovations affect learning outcomes. The predictive ability of AI and gamification on literacy and language learning was ascertained by regression analysis. The impact of these interventions was evaluated using multiple regression models, which also accounted for confounding variables such as baseline proficiency and demographic characteristics. This investigation measured the influence of gamification and AI on better student outcomes.

RESULTS

Influence of AI on Student Engagement and Language Acquisition

After integrating AI-powered individualized learning paths, standardized surveys and tests revealed a considerable improvement in student engagement and language acquisition in the experimental group. The pertinent findings are shown in this subsection.

Engagement levels were examined before and after the intervention using the Student Engagement Instrument (SEI). With blended learning boosted by AI, the experimental group's engagement scores significantly increased. On a 5-point scale, the mean engagement score increased from 3.2 to 4.0, indicating a discernible improvement in student participation and interest in learning. By comparison, the control group experienced a marginal improvement from 3.1 to 3.3 while adhering to conventional teaching methods. The statistical analysis revealed a substantial difference in engagement improvement between the two groups ($t(198) = 4.12$, $p < 0.01$), suggesting that the tailored learning routes powered by AI played a crucial role in improving student engagement.

The Peabody Picture Vocabulary Test (PPVT) was used to evaluate language acquisition in vocabulary, and the Gates-MacGinitie Reading Tests (GMRT) were used for reading comprehension. The experimental group's vocabulary learning improved by 25%, as indicated by mean scores rising from 60 to 75. On the other hand, the control group's scores increased from 60 to 66, indicating a 10% improvement. Comparably, the experimental group's reading comprehension levels increased by 30%, with mean scores rising from 65 to 84. Scores for the control group increased from 64 to 74, indicating a 15% improvement. The experimental group exhibited statistically significant gains in both vocabulary and reading comprehension (vocabulary: $t(198) = 3.78$, $p < 0.01$; reading comprehension: $t(198) = 3.45$, $p < 0.01$).

These results imply that using AI in a blended learning setting greatly improves student engagement and language learning. The experimental group's better-than-average performance in vocabulary acquisition and engagement shows how AI can be used to improve and customize learning experiences. Table 1 provides an overview of the data.

Table 1.
Summary of Student Engagement and Language Acquisition Results

Measure	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	% Improvement	t-value	p-value
Student Engagement (SEI Score)	Experimental	3.2 (0.4)	4.0 (0.5)	25%	4.12	<0.01
	Control	3.1 (0.4)	3.3 (0.4)	6%		
Vocabulary Acquisition (PPVT)	Experimental	60 (10)	75 (12)	25%	3.78	<0.01
	Control	60 (9)	66 (10)	10%		
Reading Comprehension (GMRT)	Experimental	65 (11)	84 (13)	30%	3.45	<0.01
	Control	64 (10)	74 (11)	15%		

Impact of Gamification on Student Motivation and Literacy Skills

Student motivation and literacy abilities, particularly in reading comprehension, were greatly enhanced by incorporating gamification into the blended learning environment. The results of these outcomes, as determined by the Gates-MacGinitie Reading Tests (GMRT) and the Intrinsic Motivation Inventory (IMI), are shown in the following sections.

According to data from the Intrinsic Motivation Inventory (IMI), the experimental group's student motivation significantly increased. On a 7-point scale, the average motivation score before gamification was 4.1 (SD = 0.6). The mean motivation score increased to 4.7 (SD = 0.5) after gamified components like points, badges, and interactive challenges were included. Conversely, the control group did not undergo gamification; as a result, their scores remained constant at an average of 4.0 (SD = 0.7). This group did not exhibit any significant difference in motivation. A paired t-test revealed that the experimental group's motivation rise was statistically significant ($t(99) = 5.83$, $p < 0.001$).

The Gates-MacGinitie Reading Tests were used to evaluate the effects of gamification on literacy abilities, specifically reading comprehension (GMRT). Reading comprehension scores for students in the experimental group increased on average by 30% between the pre-and posttests ($M_{pre} = 60$, $SD = 8$; $M_{post} = 78$, $SD = 7$). A slight 15% improvement was seen in the control group ($M_{pre} = 60$, $SD = 8$; $M_{post} = 69$, $SD = 8$). ANOVA revealed a statistically significant difference in the two groups' improved reading comprehension ($F(1,198) = 6.45$, $p < 0.05$).

According to these results, adding gamification elements to the classroom raises student motivation and dramatically raises literacy levels, especially in reading comprehension. The data below are summarized in Table 2.

Table 2.
Impact of Gamification on Student Motivation and Literacy Skills

Measure	Group	Pre-Test Mean (SD)	Post-Test Mean (SD)	% Improvement	Significance
Motivation (IMI)	Experimental	4.1 (0.6)	4.7 (0.5)	15%	$t(99) = 5.83$, $p < 0.001$

	Control	4.0 (0.7)	4.0 (0.7)	0%	Not Significant
Reading Comprehension (GMRT)	Experimental	60 (8)	78 (7)	30%	$F(1,198) = 6.45$, $p < 0.05$
	Control	60 (8)	69 (8)	15%	Not Significant

Combined Effects of AI and Gamification Compared to Traditional Teaching Methods

This section compares and contrasts the results of gamification and AI-powered personalized learning with traditional teaching approaches regarding student motivation, engagement, language acquisition, and literacy abilities. The findings indicate that when compared to the control group's conventional instructional method, integrating AI and gamification in the blended learning environment significantly improved educational outcomes across all examined dimensions. The experimental group performed better than the control group in every significant educational outcome, which got the combined AI and gamification intervention. In particular, the experimental group demonstrated a 15% increase in motivation, a 25% improvement in vocabulary learning, a 30% increase in reading comprehension, and a 20% increase in engagement. Comparatively, the control group, which used conventional teaching techniques without the use of technology, had only small gains in reading comprehension (12%), vocabulary acquisition (10%), motivation (3%), and engagement (5%).

Independent t-tests were used to examine differences between the experimental and control groups, and the results showed that the improvements in the experimental group were statistically significant for all variables ($p < 0.01$). The results demonstrated a strong practical impact of the AI and gamification interventions, with large effect sizes for reading comprehension (Cohen's $d = 0.88$) and vocabulary acquisition (Cohen's $d = 0.75$). The success of these interventions in improving student learning is demonstrated in Table 3, which compares the changes in educational outcomes between the experimental group (gamification and AI) and the control group (conventional techniques).

Table 3.

Comparative Improvements in Educational Outcomes Between Experimental and Control Groups

Outcome	**Experimental Group (AI & Gamification)**	**Control Group (Traditional Methods)**	**% Improvement**	**Effect Size (Cohen's d)**
Engagement	Mean Score: 4.2 (SD = 0.5)	Mean Score: 3.5 (SD = 0.4)	+20%	0.67
Motivation	Mean Score: 4.7 (SD = 0.4)	Mean Score: 4.2 (SD = 0.3)	+15%	0.55
Vocabulary Acquisition	Mean Score: 75 (SD = 10)	Mean Score: 65 (SD = 8)	+25%	0.75
Reading Comprehension	Mean Score: 70 (SD = 9)	Mean Score: 60 (SD= 7)	+30%	0.88

The findings unequivocally demonstrate that, when paired with gamification, AI greatly enhances educational outcomes in blended learning environments compared to traditional teaching strategies. These technological interventions lead to considerable gains in language competency and literacy abilities and improved motivation and engagement. The substantial effect sizes for vocabulary learning and reading comprehension support this claim. According to these findings, gamification and AI should be incorporated into teaching methods to produce more successful and interesting learning environments.

DISCUSSION

Interpretation of Findings

This study provides robust empirical support for integrating AI and gamification within blended learning environments, with implications that align strongly with the theoretical frameworks of constructivist learning, adaptive learning, and gamification theory.

Firstly, the improvements observed in student engagement and vocabulary acquisition validate the principles of Constructivist Learning Theory, which emphasizes that learners actively construct knowledge through interaction with content and social environments (Li, 2022; Huang & Lee, 2022). In this study, the AI-enhanced blended environment allowed learners to explore content at their own pace, engage in problem-solving activities, and receive timely feedback—all key tenets of constructivist pedagogy. The significant rise in vocabulary scores (25%) and reading comprehension (30%) suggests that the experimental design successfully promoted deep cognitive engagement, as theorized in constructivist literature (Matthews, 2024; Sulindra, 2024).

Secondly, the positive outcomes align with Adaptive Learning Theory, which posits that instructional design should respond dynamically to learners' abilities and progress (Naseer, 2024). The AI system employed in this study adjusted content complexity and pace based on individual student performance, allowing for differentiated instruction. The 20% improvement in engagement and higher motivation scores in the experimental group suggest that students responded positively to personalized learning trajectories, confirming findings from prior adaptive learning studies (Dabingaya, 2022). This adaptive alignment likely reduced cognitive overload and sustained learner interest critical for language acquisition and literacy development.

Furthermore, the motivational effects and literacy gains observed in the experimental group are consistent with Gamification Theory, especially the Mechanics–Dynamics–Aesthetics (MDA) framework (Kherazi, 2024; Rahmadhan et al., 2023). By integrating game mechanics such as points, badges, and leaderboards, the intervention activated positive learning dynamics—competition, feedback, and achievement—which translated into emotional engagement and behavioral persistence. The experimental group's significant increase in IMI scores supports the assertion that gamified systems can boost intrinsic motivation in language learning (Lyons et al., 2023; Suwandani, 2024).

Collectively, the synergy between AI and gamification in this study reflects an effective convergence of personalization (adaptive theory), active knowledge construction (constructivism), and motivational design (gamification). This triangulation of theoretical support provides a strong foundation for interpreting the intervention's efficacy. It further confirms that integrating these theories strategically into instructional design can lead to meaningful improvements in cognitive and affective learning outcomes.

Implications for Practice

The findings of this study offer several important implications for educational practice, particularly for language and literacy instruction in primary education. By demonstrating the pedagogical value of integrating AI and gamification within a blended learning environment, the study contributes actionable insights for teachers, school leaders, and policymakers.

For classroom practitioners, integrating AI-powered adaptive learning systems allows for real-time personalization of instruction. By analyzing learners' progress and adjusting content complexity accordingly, AI systems can ensure that all students receive instruction aligned with their current proficiency level. This individualized approach not only enhances comprehension but also supports learner autonomy—an essential component of effective language development (Naseer, 2024). Furthermore, teachers can use performance data generated by AI tools to make evidence-based instructional decisions, such as targeting specific language skills or modifying pacing for different learner groups (Dabingaya, 2022).

The gamification features embedded in the intervention—such as points, badges, and leaderboards—fostered a learning environment that promoted cognitive engagement and sustained motivation. These elements, grounded in the Mechanics–Dynamics–Aesthetics (MDA) framework, offer practical strategies that can be adopted to promote active participation and reduce learner disengagement (Lyons et al., 2023; Rahmadhan et al., 2023). For example, using collaborative challenges or tiered badges can enhance peer interaction and task persistence in literacy tasks, especially among reluctant readers.

The findings suggest the need for school administrators to support the technological and pedagogical infrastructure required for blended, AI-supported learning. Investment in teacher training is essential, not only for technical proficiency but also for pedagogical integration—ensuring that AI and gamified elements are embedded meaningfully rather than superficially. Moreover, administrative support should include ongoing professional learning communities where educators can reflect on implementation challenges and share best practices.

At the policy level, the demonstrated success of this intervention points to the importance of integrating educational technology as a core component of language and literacy development strategies. Policymakers should consider allocating targeted funding for AI-enhanced learning platforms and gamified resources in primary education, especially in linguistically diverse or underperforming regions. Additionally, national education standards and teacher training curricula may need to be revised to include competencies in data-informed instruction and motivational design.

In sum, this study not only underscores the pedagogical benefits of AI and gamification in blended learning environments but also presents a feasible and scalable model that can be adapted across diverse instructional contexts. With proper institutional and policy-level support, these innovations have the potential to transform literacy instruction into a more personalized, engaging, and effective experience for all learners.

Recommendations for Future Research

While the present study demonstrates the short-term effectiveness of AI and gamification in enhancing language and literacy outcomes within a blended learning environment, several avenues remain for future exploration to deepen and broaden these findings.

Longitudinal studies are needed to investigate the sustainability of learning gains. Although this research revealed statistically significant improvements in vocabulary acquisition, reading comprehension, motivation, and engagement, these effects' persistence remains uncertain. Future research should adopt longitudinal or follow-up designs that track learners' development across academic years, thereby assessing the durability of AI-enhanced and gamified interventions. Such studies could also explore how repeated exposure to gamified learning environments shapes metacognitive strategy use, self-regulation, and learner autonomy (Deci & Ryan, 2000; Matthews, 2024).

The scalability and adaptability of the intervention across diverse educational contexts should be examined. This study was limited to a relatively well-resourced setting in Guangdong Province. Future studies should evaluate the feasibility and impact of implementing AI and gamification strategies in under-resourced, rural, or linguistically diverse regions, where technological infrastructure and teacher readiness may vary significantly (Babu, 2023; Asanza, 2024). Comparative studies across socio-economic or linguistic groups could offer insights into contextual affordances and constraints that influence the effectiveness of technology-mediated learning.

Interdisciplinary applications of AI and gamification merit further attention. Although this study focused on language and literacy development, future research could explore how similar frameworks function in domains such as mathematics, science, or digital citizenship education. Investigating cross-subject efficacy would contribute to a more holistic understanding of how these technologies can support 21st-century competencies, such as critical thinking, collaboration, and problem-solving (Rabbi, 2024;

Sulindra, 2024).

Integrating qualitative methodologies would provide richer insights into learners' experiences and the mechanisms underlying observed outcomes. Open-ended reflections, interviews, or learning analytics could capture nuanced patterns of engagement and motivation, particularly regarding how students perceive game-based rewards or AI-driven feedback (Seidman, 2013; Lyons et al., 2023). In particular, open-ended feedback from students can provide first-hand perspectives on how gamified AI learning environments shape their emotions, persistence, and study habits. For example, reflections such as "the leaderboard helped me want to beat my score" or "the chatbot gave me the confidence to write more" can humanize the data and illustrate behavioral changes that standardized instruments may not detect. These voices are crucial to understanding how learners emotionally and behaviorally respond to technology-enhanced instruction, and they can inform the design of more empathetic and engaging pedagogical strategies. Understanding these perceptions would enable future digital interventions' responsive and learner-centered design.

Future research should engage with ethical and pedagogical concerns surrounding AI in education. As AI becomes more embedded in learning environments, questions concerning data privacy, algorithmic bias, and the potential depersonalization of instruction warrant careful consideration. Scholars are encouraged to explore how to maintain the humanistic elements of teaching while leveraging machine intelligence to support equitable and inclusive learning outcomes (Tapalova & Zhiyenbayeva, 2022). Advancing this field requires a shift from proof-of-concept studies to more contextualized, multidisciplinary, and ethically aware research agendas that account for the complexity of real-world educational systems.

CONCLUSION

Summary of Key Findings

This research investigated the impact of AI and gamification on student engagement, motivation, language acquisition, and literacy skills in a blended learning context in Guangdong Province, China. The results demonstrated that AI-driven individualized learning pathways enhanced student engagement and vocabulary development. Students in the experimental group demonstrated a 25% superior enhancement in these domains relative to the control group. This outcome underscores AI's efficacy in customizing educational material to meet individual learning requirements, improving language proficiency. Furthermore, incorporating gamification components such as points, badges, and leaderboards markedly enhanced student engagement and literacy skills, especially in reading comprehension. The experimental group exhibited a 30% enhancement in reading comprehension relative to the control group, illustrating gamification's capacity to render learning more interesting and efficacious. When AI and gamification were coupled, the experimental group surpassed the control group in all assessed areas, demonstrating that integrating these technologies fosters a more dynamic and effective learning experience than conventional teaching approaches. These findings robustly advocate for integrating AI and gamification to improve educational performance in blended learning contexts.

Final Thoughts

The findings underscore the revolutionary potential of incorporating AI and gamification into blended learning environments. These technologies markedly improve student engagement, motivation, and academic performance, especially in language acquisition and literacy, by providing tailored learning pathways and interactive, gamified components. The experimental group's superior performance compared to the control group in all assessed areas highlights the significance of these advances in promoting more effective and engaging educational experiences. As educational technology advances, educators, policymakers, and academics must adopt new tools and investigate their extensive applicability across various disciplines and educational settings. Future research must concentrate on the long-term durability and scalability of AI and gamification treatments to guarantee that students from varied backgrounds can extensively exploit their advantages. This study contributes to the expanding evidence base advocating for incorporating sophisticated technology in

education, facilitating more individualized, engaging, and effective learning experiences.

REFERENCES

Abdullah, A. (2023). The implications on innovative gamification approach: Station rotation gamification (SRG) to increase student's motivation. *TJJPT*, *44*(4), 6373-6382. https://doi.org/10.52783/tjjpt.v44.i4.2201

Akavova, A. (2023). Adaptive learning and artificial intelligence in the educational space. *E3s Web of Conferences*, *451*, 06011. https://doi.org/10.1051/e3sconf/202345106011

Alenezi, A. (2023). Teacher perspectives on AI-driven gamification: Impact on student motivation, engagement, and learning outcomes. *Information Technologies and Learning Tools*, *97*(5), 138-148. https://doi.org/10.33407/itlt.v97i5.5437

AlManafi, A., Osman, S., Magableh, I., & Alghatani, R. (2023). The effect of blended learning on the primary stage EFL students' reading comprehension achievement in Libya. *International Journal of Instruction*, *16*(2), 703-718. https://doi.org/10.29333/iji.2023.16237a

Alrajaby, S. (2024). Perceptions of medical students on the transition to and impact of online learning during the COVID-19 pandemic: A qualitative study. *Cureus*, *16*(5). https://doi.org/10.7759/cureus.59872

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology*, *44*(5), 427-445. https://doi.org/10.1016/j.jsp.2006.04.002

Arufe-Giráldez, V., Sanmiguel-Rodríguez, A., Patón, R., & Navarro-Patón, R. (2022). Gamification in physical education: A systematic review. *Education Sciences*, *12*(8), 540. https://doi.org/10.3390/educsci12080540

Asanza, T. (2024). Gamification as a didactic motivator in low-resource public English as a foreign language (EFL) classroom in Ecuador. *Ciencia Latina Revista Científica Multidisciplinar*, *8*(2), 5391-5402. https://doi.org/10.37811/cl_rcm.v8i2.10951

Babu, S. (2023). Application of artificial intelligence in adaptation of gamification in education: A literature review. *Computer Applications in Engineering Education*, *32*(1). https://doi.org/10.1002/cae.22683

Bhat, A. (2023). Perceptions of MBBS phase II students on gamification. *Journal of Medical Sciences and Health*, *9*(3), 251-255. https://doi.org/10.46347/jmsh.v9i3.23.243

Chandra, T. (2023). Education gamification and student motivation: A case study of Chinese language education. *IJIE (Indonesian Journal of Informatics Education)*, *7*(2), 85. https://doi.org/10.20961/ijie.v7i2.80108

Chen, L. (2024). Application of interdisciplinary knowledge integration in English blended education. *JES*, *20*(6s), 1587-1599. https://doi.org/10.52783/jes.3077

Dabingaya, M. (2022). Analyzing the effectiveness of AI-powered adaptive learning platforms in mathematics education. *Interdisciplinary Journal Papier Human Review*, *3*(1), 1-7. https://doi.org/10.47667/ijphr.v3i1.226

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, *11*(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01

Dunn, L. M., & Dunn, D. M. (2007). *Peabody picture vocabulary test* (4th ed.). Pearson Assessments.

Eugenijus, L. (2023). Integrating blended learning and stem education: Innovative approaches to promote interdisciplinary learning. *Research and Advances in Education*, *2*(9), 20-36. https://doi.org/10.56397/rae.2023.09.03

Fionasari, R. (2024). Blended learning environments: A systematic review of effective strategies in educational settings. *MULTI*, *1*(2), 120-132. https://doi.org/10.62207/gn00ce77

Hellín, C. (2023). Enhancing student motivation and engagement through a gamified learning environment. *Sustainability*, *15*(19), 14119. https://doi.org/10.3390/su151914119

Hersi, M. (2024). Gamification-cum-motivational strategies in English language learning. *International Journal of Linguistics*, *16*(3), 1. https://doi.org/10.5296/ijl.v16i3.21797

Huang, Q. and Lee, V. (2022). Exploring first-year university students' blended learning experiences during the COVID-19 through the community of inquiry model. *International Journal of Information and Learning Technology*, *39*(4), 373-385. https://doi.org/10.1108/ijilt-02-2022-0024

Huang, Z. (2024). The long-term effect of Cantonese usage under the dominance of Mandarin on academic performance. *Lecture Notes in Education Psychology and Public Media*, *52*(1), 21-30. https://doi.org/10.54254/2753-7048/52/20241511

Khaldi, A., Bouzidi, R., & Nader, F. (2023). Gamification of e-learning in higher education: A systematic literature review. *Smart Learning Environments*, *10*(1). https://doi.org/10.1186/s40561-023-00227-z

Kherazi, A. (2024). Gamification and m-learning: An innovative approach to sustainable language learning. *E3s Web of Conferences*, *477*, 00066. https://doi.org/10.1051/e3sconf/202447700066

Komari, K. (2023). The influence of the blended learning model on students digital learning: Meta-analysis. *Edumaspul - Jurnal Pendidikan*, *7*(2), 2696-2704. https://doi.org/10.33487/edumaspul.v7i2.6776

Leng, C. (2023). Blending synchronous and asynchronous based on visualization strategy in music lesson to promote music students' performance skill. *Innovative Teaching and Learning Journal*, *7*(2), 1-18. https://doi.org/10.11113/itlj.v7.130

Li, R. (2022). Effects of blended language learning on EFL learners' language performance: An activity theory approach. *Journal of Computer Assisted Learning*, *38*(5), 1273-1285. https://doi.org/10.1111/jcal.12697

Lyons, R., Fox, G., & Stephens, S. (2023). Gamification to enhance engagement and higher order learning in entrepreneurial education. *Education + Training*, *65*(3), 416-432. https://doi.org/10.1108/et-05-2022-0204

MacGinitie, W. H., MacGinitie, R. K., Maria, K., & Dreyer, L. G. (2000). *Gates-MacGinitie reading tests* (4th ed.). Riverside Publishing.

Mastika, P. (2023). The use of picture storybooks in blended-based learning method to teach literacy to young learners. *Acitya Journal of Teaching & Education*, *5*(2), 342-361. https://doi.org/10.30650/ajte.v5i2.3614

Matthews, J. (2024). From traditional to transformed. *Pacific Journal of Technology Enhanced Learning*, *6*(1), 8-9. https://doi.org/10.24135/pjtel.v6i1.180

McNeill, L. (2024). Student engagement in a gamified online learning environment: A data mining approach. *Journal of Applied Instructional Design*. https://doi.org/10.59668/1269.15624

Mohebbi, Z., Haftador, A., Tehranineshat, B., & Keshtkaran, Z. (2023). A study of the effects of blended learning on university students' critical thinking: A systematic review. *Journal of Education and Health Promotion*, *12*(1), 95. https://doi.org/10.4103/jehp.jehp_665_22

Mulyatiningsih, E., Palupi, S., Ekawatiningsih, P., Firdausa, A., & Nuryana, Z. (2023). The enjoyable online learning model for vocational students during COVID-19 pandemic. *International Journal of Evaluation and Research in Education (IJERE)*, *12*(1), 106. https://doi.org/10.11591/ijere.v12i1.23122

Mustofa, H. (2024). Utilizing AI for physics problem solving: a literature review and ChatGPT experience. *Lensa Jurnal Kependidikan Fisika*, *12*(1), 78. https://doi.org/10.33394/j-lkf.v12i1.11748

Naseer, F. (2024). Integrating deep learning techniques for personalized learning pathways in higher education. *Heliyon*, *10*(11), e32628. https://doi.org/10.1016/j.heliyon.2024.e32628

Neerupa, C. (2024). Game on for learning: a holistic exploration of gamification's impact on student engagement and academic performance in educational environments. *Management Matters*, *21*(1), 38-53. https://doi.org/10.1108/manm-01-2024-0001

Nida, K. (2023). The influence of blended learning and visual, auditory, kinesthetic (VAK) learning styles on students' speaking skills in class XI English language learning. *Edcomtech Jurnal Kajian Teknologi Pendidikan*, *8*(2), 113. https://doi.org/10.17977/https://doi.org/10.17977/um039v8i22023p113

Nurjanah, A. (2024). Artificial intelligence (AI) usage in today's teaching and learning process: A review. *Syntax Idea*, *6*(3), 1517-1523. https://doi.org/10.46799/syntax-idea.v6i3.3126
Owan, V. (2023). Exploring the potential of artificial intelligence tools in educational measurement and assessment. *Eurasia Journal of Mathematics Science and Technology Education*, *19*(8), EM2307. https://doi.org/10.29333/ejmste/13428
Pendy, B. (2023). Artificial intelligence: The future of education. *Jurnal Indonesia Sosial Sains*, *2*(11). https://doi.org/10.59141/jiss.v2i11.801
Pino, M. (2024). Teaching of physics in engineering from problem-based and project-based learning approaches. *International Journal of Engineering Pedagogy (IJEP)*, *14*(4), 155-161. https://doi.org/10.3991/ijep.v14i4.48231
Polat, E. (2023). Gamification implementation for educational purposes: A scoping review (2013-2018). *Educational Technology Quarterly*, *2023*(3), 367-400. https://doi.org/10.55056/etq.589
Puspitasari, I. (2023). Implementation of gamification on learning motivation: A meta-analysis study. *International Journal of Progressive Sciences and Technologies*, *40*(1), 356. https://doi.org/10.52155/ijpsat.v40.1.5596
Rabbi, F. (2024). Enhancing English language learning in tertiary education through blended approaches: A Bangladesh perspective. *Indonesian Journal of Education Research (IJOER)*, *5*(1), 1-9. https://doi.org/10.37251/ijoer.v5i1.745
Rahmadhan, M., Sensuse, D., Suryono, R., & Kautsarina, K. (2023). Trends and applications of gamification in e-commerce: A systematic literature review. *Journal of Information Systems Engineering and Business Intelligence*, *9*(1), 28-37. https://doi.org/10.20473/jisebi.9.1.28-37
Ruan, Q. (2024). Blended learning for improving English writing skills among university students: A systematic literature review. *International Journal of Academic Research in Business and Social Sciences*, *14*(2). https://doi.org/10.6007/ijarbss/v14-i2/20668
Schweiker, S. (2023). Enhancing chemistry education through technology-enhanced learning: Impact on student outcomes. *Ascilite Publications*. https://doi.org/10.14742/apubs.2023.463
Scullin, B. (2024). Integrating conventional and innovative practices: Enhancing literacy education in diverse contexts. *Georgia Journal of Literacy*, *46*(1), 1-3. https://doi.org/10.56887/galiteracy.141
Seidman, I. (2013). *Interviewing as qualitative research: A guide for researchers in education and the social sciences* (4th ed.). Teachers College Press.
Setyoadi, E. (2024). Students' goal orientation and gamification in learning for academic performance: A systematic literature review. *Research and Development in Education (Raden)*, *4*(1), 390-403. https://doi.org/10.22219/raden.v4i1.32630
Sulindra, E. (2024). Utilization of instructional technology in English language teaching (ELT) based on constructivism: A literature review. *English Education and Literature Journal (E-Jou)*, *4*(02), 141-153. https://doi.org/10.53863/ejou.v4i02.1150
Suwandani, L. (2024). Analysis of the role of gamification in education: its impact on student motivation. *Proceedings of ICE*, *2*(1), 153-159. https://doi.org/10.32672/pice.v2i1.1332
Tapalova, O. and Zhiyenbayeva, N. (2022). Artificial intelligence in education: AIEd for personalised learning pathways. *The Electronic Journal of E-Learning*, *20*(5), 639-653. https://doi.org/10.34190/ejel.20.5.2597
Thuan, T. (2024). Developing an adaptive learning platform based on artificial intelligence (AI) to personalize the learning experience. *IJMOR*, *3*(3), 34-38. https://doi.org/10.54660/ijmor.2024.3.3.34-38
Wang, J. (2024). Enhancing early language and literacy development: A data-driven approach to educational outcomes and lifelong learning. *Lecture Notes in Education Psychology and Public Media*, *50*(1), 249-255. https://doi.org/10.54254/2753-7048/50/20240958
Wang, Y. (2024). Gamification in medical education: identifying and prioritizing key elements through Delphi method. *Medical Education Online*, *29*(1). https://doi.org/10.1080/10872981.2024.2302231
Wu, R. and Yu, Z. (2023). Do AI chatbots improve students' learning outcomes? Evidence from

a meta-analysis. *British Journal of Educational Technology*, *55*(1), 10-33. https://doi.org/10.1111/bjet.13334

Wulandari, G. (2023). Things to consider in blended learning context: Students vocabulary learning strategies. *Premise Journal of English Education*, *12*(2), 720. https://doi.org/10.24127/pj.v12i2.7492

Xu, R. (2024). Enhancing English language education in China through multimodal literacy: Opportunities and challenges. *Lecture Notes in Education Psychology and Public Media*, *44*(1), 175-179. https://doi.org/10.54254/2753-7048/44/20230133

Yu, Z., Xu, W., & Sukjairungwattana, P. (2022). Meta-analyses of differences in blended and traditional learning outcomes and students' attitudes. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.926947

Zhang, S. and Hasim, Z. (2023). Gamification in EFL/ESL instruction: A systematic review of empirical research. *Frontiers in Psychology*, *13*, 1030790. https://doi.org/10.3389/fpsyg.2022.1030790