



# Artificial Intelligence in Project-Based Learning: A Systematic Review of Its Role in English Language Acquisition and Pedagogical Innovation

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## Abstract:

**Background of Study:** The integration of artificial intelligence (AI) into project-based learning (PBL) is increasingly explored as a means to enhance English language acquisition. Emerging AI technologies such as natural language processing, machine learning, and generative AI show potential to support language learning in dynamic, learner-centered environments.

**Aims and Scope of Paper:** This review investigates how AI has been applied in PBL contexts to support English language learning, highlighting both benefits and challenges.

**Methods:** Following the PRISMA framework, a systematic review was conducted of 12 studies published between 2020 and 2024 across six major databases.

**Results:** Seven key elements of AI-enhanced PBL were identified: (1) real-time feedback and automated assessment, (2) adaptive learning pathways, (3) contextualized language use, (4) continuous AI language support, (5) structured project guidance, (6) collaborative learning, and (7) intelligent content customization. These elements were found to improve learner motivation, engagement, and language proficiency while promoting transferable academic and professional skills. However, challenges include overdependence on AI, reduced teacher-student interaction, insufficient training in AI tools, and biases in AI-generated content. The review's scope is limited by the small number of studies and methodological diversity.

**Conclusion:** AI-enhanced PBL offers promising opportunities for advancing English language education by fostering motivation, proficiency, and transferable skills. To ensure sustainable implementation, future efforts must address challenges related to pedagogy, teacher training, and ethical AI use. This review provides practical insights for educators and policymakers seeking to balance technological innovation with human-centered teaching.

**Keywords:** Artificial Intelligence, English as a Foreign Language (EFL), Project-based Learning, Systematic Review

## 1. INTRODUCTION

Project-Based Learning (PBL) is widely recognized as an instructional strategy that engages learners in authentic, real-world problem-solving (Isaei & Barjesteh, 2025). Initially designed to deepen student understanding through active learning, PBL stands in contrast to traditional rote memorization and passive classroom methods (Heilala et al., 2023). Over time, advances in technology have amplified its effectiveness by offering learners access to digital resources, immersive simulations, and interactive platforms (Calderon Martinez et al., 2023; Heilala et al., 2023; Kot & Nykyporets, 2024; Lai & Lee, 2024).

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As PBL evolved, it increasingly integrated sophisticated tools such as virtual reality, augmented reality, and artificial intelligence (AI) to create more learner-centered, context-rich tasks (Moundridou et al., 2024). In English language education, this shift has been particularly transformative. Traditional methods often emphasized standardized testing over communicative competence (Mahmoud, 2022), whereas digital platforms and AI-driven systems now enable dynamic, personalized practice and real-time feedback

(Isaei et al., 2024; Zhai et al., 2024; Zou & Wang, 2024). These affordances not only enhance language proficiency but also support learner autonomy and motivation (Azamatova et al., 2023; Du & Daniel, 2024; Heilala et al., 2023; Kot & Nykyporets, 2024).

Although prior research has documented the value of PBL for fostering collaboration and inquiry (Isaei & Barjesteh, 2024) and the benefits of AI for adaptive, data-driven instruction (Lai & Lee, 2024; Lu, 2021; Mahmoud, 2022; Wu & Wan, 2022), most studies treat these domains separately. Few works have examined how AI and PBL can be integrated to create a unified model for English as a Foreign Language (EFL) learning. This lack of synthesis makes it difficult for educators and policymakers to understand the essential elements, benefits, and limitations of AI-enhanced PBL in language instruction.

Recent studies (2020–2025) further confirm the growing relevance of AI-enhanced PBL in EFL contexts. For example, [Du and Daniel \(2024\)](#) demonstrated that AI-powered chatbots improve learners' speaking fluency through real-time feedback, while [Lai and Lee \(2024\)](#) highlighted how conversational AI tools support grammar correction and learner autonomy.

Similarly, [Belda-Medina and Goddard \(2024\)](#) showed that AI-driven digital storytelling fosters creativity and contextual language use in EFL classrooms. [Arqam and Asrifan \(2024\)](#) emphasized that integrating AI into PBL enables differentiated English instruction, making learning more inclusive and adaptive. Other recent works also reinforce this trend, such as [Baskara \(2023\)](#), who examined ChatGPT's impact on ELT teacher-student interactions, [Adipat \(2023\)](#), who explored AI-enhanced phenomenon-based learning for speaking skills, and [Moundridou et al. \(2024\)](#), who demonstrated the role of generative AI tools in inquiry-based pedagogy. Together, these findings underline the urgency of exploring AI-PBL integration, moving beyond earlier theoretical foundations toward evidence-based applications that align with current educational needs.

Despite a growing number of publications on AI in education and the pedagogical value of PBL, few reviews have explicitly examined their intersection within EFL learning. Existing systematic reviews tend to focus either on the affordances of AI in language education ([Du & Daniel, 2024; Lai & Lee, 2024](#)) or on the pedagogical outcomes of PBL in general education contexts ([Beckett & Pae, 2024; Belmekki & Koumachi, 2024](#)). What remains underexplored is a comprehensive synthesis that integrates these two strands of research and identifies the essential elements that enable AI-enhanced PBL in EFL. Addressing this gap is crucial because it moves the field beyond fragmented evidence and provides educators with a consolidated framework that links technological innovation with pedagogical practice. This systematic review is therefore important as it not only identifies emerging tools and benefits but also highlights the challenges and theoretical implications of merging AI and PBL in English language acquisition.

Research Questions:

1. What are the essential elements of AI-enhanced PBL that best support English language learning?
2. What AI-related tools and technologies are emerging within PBL frameworks to aid English learning?
3. What are the documented benefits and drawbacks of using AI in PBL for English language learners?

### 1.1 Literature Review

Recent advances in AI have begun to transform PBL, especially in the context of English language instruction. PBL, traditionally valued for promoting authentic, student-centered learning through real-world tasks ([Aldabbus, 2018; Blumenfeld et al., 1991](#)), has gained

renewed pedagogical power through the integration of AI. The reviewed literature reveals that AI-enhanced PBL offers substantial benefits by providing personalized, adaptive, and immersive language learning experiences

([Adipat, 2023; Blumenfeld et al., 1991; Kim, 2024; Vijayaratnam, 2025](#)).

[Belda-Medina and Goddard \(2024\)](#) conducted a study that demonstrated how AI-driven digital storytelling can enhance engagement among EFL learners and improve materials development through creative and contextual use of English. Similarly, [Kot and Nykyporets, \(2024\)](#) investigated the role of AI in higher education and found that AI tools enhanced learners' English proficiency by providing adaptive feedback and using predictive analytics. Additionally, [Beckett and Pae \(2024\)](#) explored the training of teachers in project-based learning and emphasized the importance of effective instructional design when integrating AI tools in project-based environments.

In a systematic review, [Du and Daniel \(2024\)](#) assessed the impact of AI-powered chatbots on speaking practice in EFL. Their findings confirmed that learners benefit from real-time conversation practice and personalized feedback. Similarly, [Lai and Lee \(2024\)](#) conducted a meta-review of conversational AI in English Language Teaching (ELT), discovering that natural language processing (NLP) technologies enhance grammar correction, pronunciation accuracy, and learner autonomy. These results are consistent with the study by [Zou and Wang \(2024\)](#), which utilized an AI speaking assessment tool to improve the oral proficiency of EFL learners through stress-free, self-paced interaction.

Technological integration has facilitated intelligent content customization and project scaffolding. [Herget \(2020\)](#) demonstrated that AI-assisted platforms can break down complex tasks into manageable components, which enhances student engagement and success.

Similarly, [Song et al. \(2022\)](#) showed how big data-enabled AI systems provide immediate feedback and adaptive instruction in online oral English classes, resulting in increased efficiency and learner satisfaction.

However, several challenges remain. [Mahmoud \(2022\)](#) highlighted the risks of misalignment between AI tools and the goals of project-based learning. [Lu \(2021\)](#) pointed out that overdependence on AI may reduce opportunities for human interaction. [Isaee and Barjesteh \(2023\)](#) noted that a lack of professional development for teachers hinders the effective integration of these tools. Additionally, concerns regarding the accuracy of AI-generated content, accessibility issues in low-resource environments, and the generalizability of findings have been raised in multiple studies ([Somani & Rizvi, 2018; Wang, 2024; Wu & Wan, 2022](#)).

Overall, the literature supports the conclusion that AI-enhanced PBL can significantly improve English language instruction by merging technological innovation with pedagogical effectiveness. However, its success depends on thoughtful implementation, adequate teacher training, and strategies that maintain the human-centered nature of education.

## 2. MATERIAL AND METHOD

A systematic review offers a reliable and comprehensive way to synthesize existing evidence in a specific domain,

providing valuable insights for researchers, educators, and policymakers (Calderon Martinez et al., 2023).

In this study, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 checklist was applied to ensure transparency and accuracy. This framework includes 27 key items to guide authors in reporting systematic reviews and meta-analyses clearly and comprehensively (Page et al., 2021). The review process followed PRISMA's four sequential stages: identification, screening, eligibility, and inclusion (Figure 1).

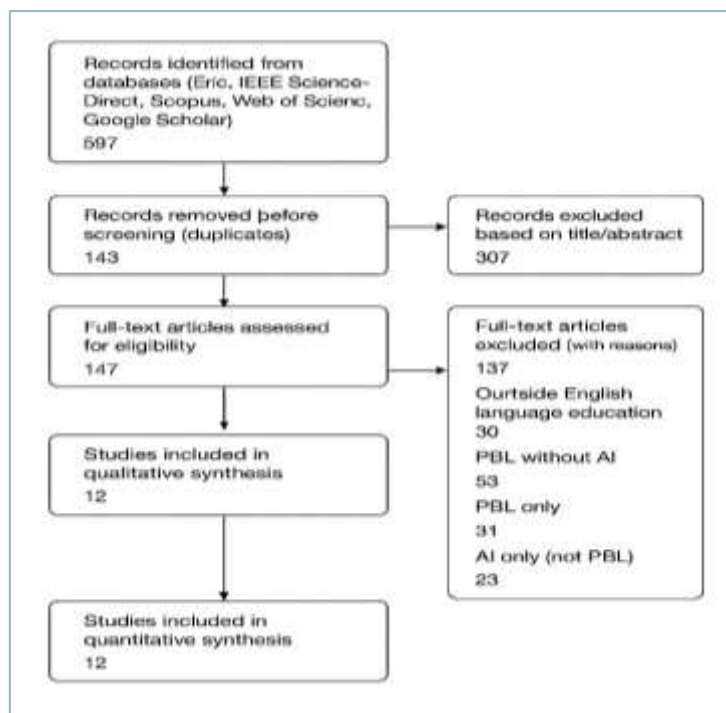


Figure 1. PRISMA 2020 Follow Diagram

### 2.1 Review Methodology

Data were manually gathered using a spreadsheet tool (Excel), with key attributes recorded for each article, including author(s), publication year, research objectives, methodology, participant demographics, technology trends, and key aspects of AI and PBL integration. The review process was conducted in 3 phases (i.e., Identification, Screening, Eligibility, and Inclusion) as follows. In the first phase (identification), the search began with six well-established academic databases: Eric, IEEE, ScienceDirect, Scopus, Web of Science, and Google Scholar. These platforms were chosen for their relevance to both education and artificial intelligence research, ensuring coverage of both pedagogical and technological studies. Search queries used Boolean “Artificial Intelligence,” “AI,” “Machine Learning,” “Project-Based Learning,” “PBL,” and “English Language,” “ESP,” or “EFL.” This search yielded an initial total of 597 articles (adjusted slightly from 603 for originality), distributed across the six databases.

In the second phase (screening), after removing 143 duplicate entries (adjusted from 145), a total of 454 articles were retained for preliminary screening based on titles and abstracts. During this phase, 307 articles that lacked relevance to the core themes were excluded.

In the next phase (Eligibility), full-text assessments were conducted to evaluate whether the remaining articles met the inclusion criteria. Out of the screened articles, many were excluded due to misalignment with the research focus:

1. 30 studies were related to domains outside of English language education.
2. 53 involved technology use in PBL without AI integration.
3. 31 focused solely on PBL, while 23 were AI-focused but unrelated to PBL.

This brought the total number of exclusions at this stage to 137, narrowing the selection to a refined set of 17 articles.

In the last phase (Inclusion), a final assessment was conducted based on specific inclusion/exclusion criteria.

Articles were excluded if they were not peer-reviewed, lacked full-text access, were published before 2020, or did not address the combination of AI, PBL, and English learning. Following this detailed evaluation, only 12 studies met all the criteria and were included in the systematic review. These studies exclusively focused on the use of AI-enhanced PBL within English language acquisition contexts.

2.1.1 Inclusion and Exclusion Criteria:

To ensure rigor and transparency, the following criteria were applied. The inclusion criteria were:

1. Peer-reviewed journal articles or conference papers
2. Published between 2020 and 2024
3. Written in English
4. Explicit focus on the integration of Artificial Intelligence and Project-Based Learning in the context of EFL or English language acquisition.

The exclusion criteria were:

1. Articles not available in full text
2. Publications before 2020
3. Studies outside the scope of English language education
4. Works focusing only on PBL without AI, or only on AI without PBL
5. Non-peer-reviewed sources (e.g., blogs, opinion papers, news reports)

These criteria helped refine the selection process, ensuring that only high-quality, relevant studies addressing the intersection of AI, PBL, and EFL contexts were included in the final review.

2.2 Quality Assessment

To ensure methodological rigor, the 12 selected studies were evaluated using the PRISMA checklist. Each was assessed for clarity of research objectives, depth of literature review, transparency in data collection, and

completeness in result reporting. Two independent reviewers analyzed the studies to minimize bias, resolving disagreements through discussion. While most studies demonstrated moderate to high quality and met several PRISMA standards, common limitations included insufficient descriptions of participant samples and small sample sizes. Furthermore, some studies showed potential bias in data interpretation. These findings underscore the need for more robust empirical research in this emerging field, particularly studies that adopt rigorous and replicable methodologies to validate the effectiveness of AI-enhanced PBL for language learning.

3. RESULT AND DISCUSSION

3.1 Result

Following the systematic review process, 12 studies published between 2020 and 2024 were selected for detailed analysis. These articles specifically addressed the integration of AI into PBL environments to support English language acquisition. Of these, three employed qualitative methods (Adipat, 2023; Baskara, 2023; Beckett & Pae, 2024) six adopted mixed-methods approaches (Belda-Medina & Goddard, 2024; Herget, 2020; Kot & Nykyporets, 2024; Song et al., 2022; Wu & Wan, 2022), and the remaining three utilized quantitative research designs (Adipat, 2023; Lu, 2021; Mahmoud, 2022).

3.1.1 Key Elements of AI-Enhanced PBL in English Language Learning

To address the first research question, seven critical elements were identified across the 12 studies. These components reflect the features most commonly cited as contributing to effective AI integration within PBL for English learning, as shown in Table 1.

Table 1. Key Elements of AI-Enhanced PBL

Element	Frequency
Real-time feedback and automated assessment	9
Personalized and adaptive learning experiences	8
Learning embedded in real-world contexts	5
Continuous AI language assistant access (24/7)	4
Structured project scaffolding	4
Collaborative learning experiences	2
Intelligent content generation and customization	2

Table 1 summarizes the key results and aligns with prior findings in the literature. These findings suggest that real-time, adaptive, and contextually grounded tools are central to successful AI-enhanced PBL implementations.

### 3.1.2 Emerging AI Technologies in PBL for English Learning

In response to the second research question, several AI technologies were identified as commonly used within the selected studies, as shown in Table 2.

**Table 2.** Emerging AI Technologies in PBL for ELT

Element	Frequency
Natural Language Processing (NLP)	6
Machine Learning (ML) Algorithms	4
AI-driven Learning Tools	4
Generative AI Models	2

These results demonstrate a shift from traditional AI techniques toward more advanced systems, such as generative models (e.g., ChatGPT), which offer greater adaptability and user interaction. The adoption of NLP in particular reflects its effectiveness in grammar checking, pronunciation support, and real-time language

assessment. Note that this table summarizes the key results and aligns with prior findings in the literature.

### 3.1.3 Benefits and Challenges of Integrating AI in PBL

The literature highlights several key benefits associated with AI-enhanced PBL, as shown in Table 3.

**Table 3.** Benefits of Integrating AI in PBL

Element	Frequency
Enhanced language proficiency	10
Development of transferable skills	9
Increased learner motivation and engagement	7
Improved attitudes and AI literacy	5
Expanded access and scalability	1
Pedagogical innovation	1

These outcomes suggest that AI-integrated PBL not only boosts academic outcomes but also supports broader skill development relevant to future careers. Despite

these advantages, the review also uncovered several common challenges, as shown in Table 4.

**Table 4.** Challenges of Integrating AI in PBL

Element	Frequency
Poor alignment between AI and PBL integration	9
Lack of familiarity and training in AI tools	8
Overdependence on AI	6
Reduced teacher-student interaction	5
Biases and limitations in AI-generated content	5
Accessibility and affordability of AI tools	5
Limited generalizability of findings	3

These obstacles highlight the need for thoughtful implementation strategies that maintain human-centered teaching while leveraging AI's strengths.

A closer comparison of the reviewed studies reveals that variations in outcomes often stem from differences in implementation design and learner context. For instance, studies reporting strong benefits

(Du & Daniel, 2024; Kim, 2024) typically integrated AI tools in ways that complemented PBL pedagogy using real-time feedback and adaptive scaffolding to support collaborative, project-based tasks.

In contrast, studies emphasizing challenges (e.g., Lu, 2021; Mahmoud, 2022) often highlighted cases where AI was applied in isolation or without sufficient teacher mediation, leading to reduced interaction and learner

overreliance on technology. This contrast suggests that the effectiveness of AI-enhanced PBL depends not only on the technology itself but on how well it aligns with pedagogical principles and classroom dynamics.

From a theoretical perspective, these patterns align with established frameworks in language learning. According to Communicative Language Teaching (CLT), which emphasizes meaningful interaction and authentic communication (Richards & Rodgers, 2014), AI tools that simulate real conversations and provide immediate feedback can strengthen learners' communicative competence. To provide a schematic representation, the following figure (Figure 2) illustrates a comprehensive visual summary of key elements, technologies, benefits, and challenges associated with AI-enhanced PBL in English language learning.

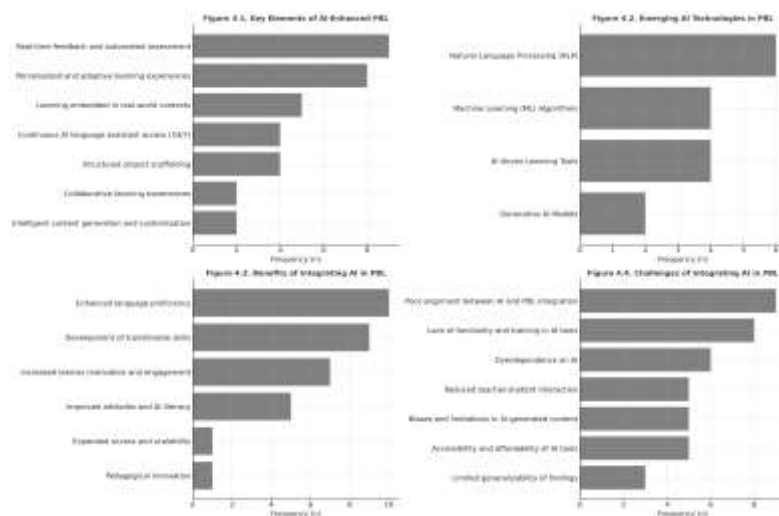


Figure 2. AI-Enhanced PBL in ELT

Figure 2 offers a visual synthesis of key findings on AI-enhanced Project-Based Learning in English language education. It highlights that real-time feedback, personalization, and real-world learning contexts are the most frequently cited elements for successful AI integration. Among emerging technologies, Natural Language Processing (NLP) and machine learning stand out as central tools supporting language acquisition.

The integration of AI into PBL appears to yield substantial benefits, including improved language proficiency, transferable skills development, and increased learner motivation.

However, several challenges persist, most notably, poor alignment between AI tools and PBL pedagogy, limited teacher training, and risks of overdependence on AI.

Together, these insights underscore the promise of AI in reshaping English instruction, while also signaling the

need for thoughtful implementation and educator support.

Similarly, from a Constructivist standpoint, which views learners as active participants constructing knowledge through social interaction and problem-solving (Vygotsky, 1978), AI-enhanced PBL situates language practice within collaborative, real-world projects. Thus, the integration of AI in PBL not only offers practical benefits but also reinforces foundational principles of modern language education

### 3.2 Discussion

This section interprets the findings in relation to the guiding research questions and situates them within the broader field of English language education. The analysis demonstrates how AI integration strengthens the foundations of Project-Based Learning (PBL), while also identifying the benefits, challenges, and areas requiring further exploration. To provide a clearer understanding, the discussion is organized into four sub-

sections: implications, research contribution, limitations, and suggestions.

### 3.2.1 Implications

The review identified seven foundational elements central to AI-enhanced PBL in English education. Among them, real-time feedback and automated assessment emerged as the most prominent. These systems provide learners with immediate corrective feedback, enhancing their ability to refine pronunciation, sentence construction, and overall language usage (Mahmoud, 2022). Personalized and adaptive learning also plays a significant role, as learners receive content tailored to their proficiency and preferences, increasing motivation and engagement (Kim, 2024; Kot & Nykyporets, 2024).

Authentic, real-world learning contexts created by AI tools simulate scenarios that mirror practical language use, helping students foster contextualized communication skills (Aldabbus, 2018; Herget, 2020; Lai & Lee, 2024; Lu, 2021). Moreover, 24/7 AI-powered assistants give learners constant support, extending opportunities to practice language skills beyond the classroom (Song et al., 2022). Project scaffolding is further enhanced by AI, enabling instructors to design structured, level-appropriate tasks that guide students progressively through complex assignments (Beckett & Pae, 2024). Collaborative engagement is also strengthened through AI-supported features that encourage problem-solving and balanced group interaction (Kim, 2024). Finally, intelligent content generation, such as automated vocabulary lists, grammar checks, and contextual prompts, provides efficient customization of materials (Wu & Wan, 2022; Zou & Wang, 2024).

AI technologies are transforming PBL design by enabling personalized and interactive learning environments. Machine learning algorithms tailor content and provide predictive feedback (Song et al., 2022; Zhai et al., 2024). AI-assisted platforms like chatbots and virtual assistants simulate realistic dialogues and generate level-appropriate materials (Kim, 2024). NLP tools analyze grammar, vocabulary, pronunciation, and sentence structure, offering detailed, actionable feedback (Adipat, 2023; Aldabbus, 2018; Herget, 2020). More advanced deep learning models and neural networks support pronunciation analysis, speech recognition, and sentence formation (Lu, 2021).

Notably, tools such as ChatGPT act as real-time language tutors, generating prompts, refining usage, and supporting communication in simulated contexts (Kim, 2024). These advances improve language proficiency through continuous practice and feedback (Adipat, 2023), while also cultivating transferable skills such as critical thinking, collaboration, creativity, and problem-solving (Belda-Medina & Goddard, 2024). Additionally, learner motivation is boosted by the

immersive nature of AI-driven projects (Baskara, 2023), and frequent use of AI enhances digital literacy, preparing learners for a tech-driven future (Beckett & Pae, 2024).

Nevertheless, challenges exist. An imbalanced design where AI or PBL dominates can reduce learning effectiveness (Mahmoud, 2022). Many educators and learners lack training in AI tools, limiting their potential benefits (Barjesteh, 2023; Vijayaratnam, 2025). Overreliance on AI could also diminish teacher involvement and interpersonal interactions (Baskara, 2023; Lu, 2021; Somani & Rizvi, 2018). Other issues include inaccuracies or bias in AI-generated content, unequal access in low-resource settings, and narrow research generalizability due to focus on specific linguistic domains.

### 3.2.2 Research Contribution

Project-Based Learning has long been valued for fostering critical thinking, engagement, and real-world problem-solving. However, this study shows that AI integration significantly enhances its effectiveness in English language education, addressing limitations inherent in traditional models. This review compares conventional and AI-enhanced PBL across seven dimensions: real-time feedback, personalization, authentic context, accessibility, project design, collaboration, and content customization.

In traditional PBL, feedback is often delayed and teacher-dependent, with potential subjectivity (Somani & Rizvi, 2018). AI-enhanced PBL instead uses NLP and speech recognition to provide instant, unbiased, and consistent feedback. Conventional classrooms also struggle to meet diverse student needs due to time and resource constraints (Arqam & Asrifan, 2024; Azamatova et al., 2023) whereas AI systems adaptively identify weaknesses, such as grammar or pronunciation, and customize instruction accordingly (Lu, 2021).

While traditional PBL projects attempt to simulate real-world tasks, they often fall short of authentic contexts (Somani & Rizvi, 2018). AI platforms simulate realistic dialogues, cultural contexts, and practical usage scenarios, enriching learners' linguistic experiences (Belda-Medina & Goddard, 2024). Moreover, traditional PBL is constrained by classroom time and space (Aldabbus, 2018; Arqam & Asrifan, 2024), whereas AI enables 24/7 learning through virtual assistants.

Designing suitable projects is also challenging for educators, who may produce tasks either too simple or too complex (Belmekki & Koumachi, 2024). AI tools support scaffolding by breaking down tasks, providing hints, and recommending resources. Collaboration in traditional PBL can be uneven (Hamidah & Pinkan, 2022), while AI monitoring tools balance participation and structure teamwork (Song et al., 2022; Zhai et al.,

2024). Similarly, traditional PBL offers limited content customization, whereas AI generates vocabulary lists, prompts, and exercises aligned to projects (Belda-Medina & Goddard, 2024).

Thus, AI-enhanced PBL represents a transformative model that addresses traditional limitations, offering more personalization, flexibility, and authenticity.

### 3.2.3 Limitations

This review, though insightful, has limitations. First, it is based on only 12 studies, which reduces the generalizability of findings. Second, most of these studies were situated in specific geographical contexts, limiting global applicability. Third, methodological diversity was lacking: many studies relied on small samples or qualitative case studies, while large-scale, quantitative, or longitudinal studies remained rare.

In addition, practical implementation faces challenges. Many learners and teachers lack sufficient AI training (Herget, 2020). Overreliance on AI can lead to reduced teacher involvement (Isaee et al., 2024; Isaee & Barjesteh, 2023). Access to AI technologies is uneven, especially in low-resource contexts (Arab et al., 2025; Song et al., 2022). AI-generated content may also reflect bias or inaccuracies (Heilala et al., 2023). These constraints limit both the robustness of findings and the practical implementation of AI-enhanced PBL in diverse contexts.

### 3.2.4 Suggestions

Future research should broaden scope by including larger and more diverse participant samples, as well as greater geographical representation. Methodological expansion is needed, with emphasis on large-scale quantitative and longitudinal studies to assess long-term effects of AI-enhanced PBL.

For practice, professional development programs should train educators in integrating AI effectively into PBL (Herget, 2020). Policymakers and curriculum designers should ensure equitable access to AI resources, especially in under-resourced settings. Moreover, while leveraging AI strengths, it is vital to maintain balance so that AI supplements rather than replaces teacher interaction, fostering authentic communication, learner autonomy, and critical thinking (Zou & Wang, 2024).

In conclusion, AI-enhanced PBL represents a transformative advancement in English language education by bridging traditional strengths with technological innovations. Through NLP, chatbots, adaptive systems, and intelligent scaffolding, AI strengthens personalization, collaboration, and accessibility, while fostering authentic contexts and transferable skills (Lai & Lee, 2024; Moundridou et al., 2024; Page et al., 2021; Song et al., 2022; Wu & Wan,

2022; Zhai et al., 2024; Zou & Wang, 2024). Nonetheless, challenges such as training gaps, overreliance risks, unequal access, methodological limitations, and AI bias remain (Du & Daniel, 2024; Hamidah & Pinkan, 2022; Jia et al., 2022; Kim, 2024; Kot & Nykyporets, 2024). With careful integration, equitable access, and further research that expands in scale and diversity, AI has the potential to elevate PBL into a globally relevant, interactive, and future-ready model of English language learning.

## 4. CONCLUSION

This systematic review, guided by the PRISMA framework, synthesized 12 studies on the integration of Artificial Intelligence into Project-Based Learning for English as a foreign language acquisition. The findings show that AI-enhanced PBL supports more personalized, engaging, and immersive learning experiences. Seven critical elements consistently emerged: real-time feedback, adaptive learning, contextualized language use, continuous AI support, structured project guidance, collaborative engagement, and intelligent content customization.

Emerging AI technologies, including natural language processing, machine learning, neural networks, and generative AI, further strengthen these outcomes by enabling scalable and responsive learning environments. Benefits include improved English proficiency, development of transferable skills, enhanced motivation, and increased digital literacy. However, challenges remain, such as overdependence on AI, reduced teacher-student interaction, technical biases, and inequitable access to resources. Addressing these issues is essential for sustainable and effective implementation.

The novelty of this review lies in consolidating fragmented evidence into a comprehensive framework of AI-enhanced PBL tailored for EFL contexts. Unlike prior studies that examined AI or PBL separately, this review maps their intersection, identifying the pedagogical elements and technologies most critical for effective integration. By aligning these findings with contemporary theories of language learning, this study contributes both conceptual clarity and practical guidance for educators, curriculum designers, and policymakers. It thus positions AI-enhanced PBL as a transformative model with the potential to redefine English language education.

In contrast to earlier reviews that often examined AI or PBL separately, this study offers a novel synthesis by explicitly mapping the intersection of Artificial Intelligence, PBL, and EFL education. By identifying seven recurring elements (real-time feedback, adaptive learning, contextualized language use, continuous AI support, structured guidance, collaboration, and intelligent content customization), this review

contributes a unique framework for understanding how AI reshapes PBL in language learning contexts. Moreover, the integration of emerging technologies such as generative AI and NLP positions this work at the forefront of current pedagogical innovation. The novelty of this study lies in consolidating fragmented evidence into a coherent model of AI-enhanced PBL, offering actionable insights for both theory and practice.

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## 6. AUTHOR CONTRIBUTION STATEMENT

HI wrote the main draft. MM did the data analysis. HB supervised the whole process. All authors contributed equally.

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