The Effectiveness of The Artificial Intelligence (AI) into Project-Based Learning (PjBL) to Foster Learner Speaking Performance

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ABSTRACT:
This study investigated the effectiveness of integrating Artificial Intelligence (AI) tools, namely ChatGPT and ELSA Speak, into Project-Based Learning (PjBL) to improve students' speaking performance in a Buddhist College in Central Java. A mixed-methods design with an exploratory sequential approach was employed, involving 32 students in the experimental class and 32 students in the control class. Data were collected through speaking tests, observation sheets, questionnaires, interviews, and document analysis, and were analyzed using SPSS and thematic analysis. The quantitative findings revealed that the experimental class achieved a significant improvement in speaking performance, with the mean score increasing from 63.47 in the pre-test to 81.59 in the post-test, compared to the control class which improved from 65.78 to 76.97. The Mann-Whitney U Test confirmed a statistically significant difference between the two groups ($p < 0.05$), indicating the effectiveness of AI-integrated PjBL. Qualitative findings supported these results, showing that AI tools enhanced students' pronunciation, fluency, vocabulary, grammar, and confidence through interactive practice and immediate feedback. ChatGPT assisted in content development and language structuring, while ELSA Speak supported pronunciation accuracy. The study concludes that AI-integrated PjBL is an effective and innovative approach for improving speaking performance, as it combines technology, collaboration, and meaningful learning experiences in higher education contexts.

Keywords: Artificial Intelligence, Project-Based Learning, Speaking Performance, ChatGPT, ELSA Speak.

Introduction

Based on EF EPI 2022 data, Indonesia ranks 81st out of 111 countries with a score of 469, or it is in the intermediate level/B1. It can be said that the English proficiency is very low, especially in Indonesia (Chan, & Liu, 2025). Key issues include a lack of motivation, overly theoretical teaching methods, limited facilities, and innovative teaching conducted by professional English educators, which results in the quality of English speaking being very poor. Law number 12 of 2012, English is often required by the university's Internal Policies. For these reasons, Buddhist College in Central Java also formulates English 1 and 2 as a solution to face the issues by putting them in the curriculum. Teaching English

in non-English study programs has serious issues, which are structural and pedagogical situations. Sometimes it is positioned as an additional subject, rather than the main course, with the objective of creating and contributing to developing English performance for all skills. As a result, learning time is limited, the curriculum lacks contextualization, and learning outcomes are not completely successful in meeting learners' academic and professional need (Madzlan et al., 2023). The Table above is the result of observation before the researcher has been conducted

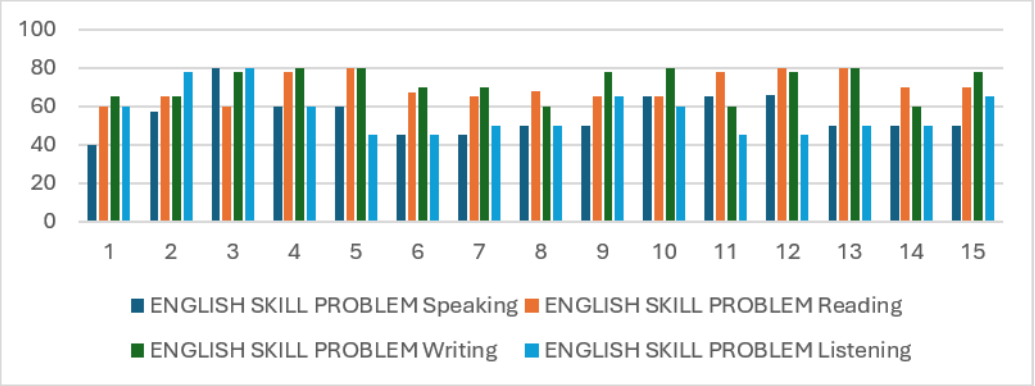


Chart 1.1 Preliminary Research Results of English Teaching Problems

The data presented in Chart 1.1 illustrate an imbalance in students' English language performance, with speaking identified as the weakest skill compared to other language skills. The students' speaking achievement ranges from 45–60%, which is lower than reading (60–75%), writing (65–80%), and listening (55–70%). This finding indicates that students at Buddhist College experience significant challenges in developing English speaking proficiency, highlighting the need for an innovative instructional approach to address this issue. Katemba and Grace (2023) emphasize that speaking instruction requires innovation in teaching approaches and materials, supported by appropriate technology, to enhance learners' speaking performance. In line with the Minister of Education and Culture Regulation No. 103 of 2014, Regulation No. 35 of 2018, the Independent Curriculum policy, and Directorate General Regulation No. 27 of 2022 concerning project-based learning implementation in higher education, learning processes should be collaborative, student-centered, and oriented toward meaningful projects and activities. Therefore, Project-Based Learning (PjBL) is considered an appropriate approach for speaking instruction because it encourages learners to collaborate and actively use English in authentic contexts. Previous studies have demonstrated that PjBL can improve students' creativity, motivation, innovation, and communication skills through project development and presentation activities (Godwin, 2024). Furthermore, Rist et al. (2022) confirm that PjBL contributes to building a learning community where students actively engage in knowledge construction and language practice. Omelianenko and Artyukhova (2024) explain that PjBL provides opportunities for learners to use the target language actively through activities such as presentations, interviews, and multimedia projects, while Kamil and Muhammad (2021) found that PjBL supports continuous speaking practice and skill development through each stage of the learning process.

To address students' speaking difficulties, this study integrates Artificial Intelligence (AI) into Project-Based Learning (PjBL) as an innovative pedagogical framework in which PjBL provides a collaborative learning environment for students to explore and practice speaking performance, while AI functions as a supporting tool controlled and guided by the lecturer. In accordance with Ministerial Regulation No. 13 of 2025, educators are encouraged to utilize technology to strengthen the depth and quality of learning. In this integration, ChatGPT is applied to support

students in developing speaking components, including grammar, comprehension, pronunciation, and vocabulary mastery, while ELSA Speak is used to provide feedback on pronunciation accuracy and fluency development. Previous studies confirm that AI-based tools can reduce students' difficulties in mastering linguistic aspects of speaking and provide opportunities for independent practice through authentic projects, such as English video creation and presentations (Yiling et al., 2025; Valenzuela & Castillo; 2023). Furthermore, AI-supported speaking practice can reduce students' anxiety and provide additional opportunities to improve their speaking performance (Hùng Cường, 2024; Choi, 2025; Wiboolyasarin et al., 2025; Qiao & Zhao (2023). Based on the explanation above, it can be formulated the research question how is the effectiveness of AI into Project-based learning to foster students' speaking performance?

Literature Review

Artificial Intelligence

To address the complexity of students' speaking performance problems, this study integrates Artificial Intelligence (AI) into Project-Based Learning (PjBL), where PjBL provides a collaborative learning environment for students to explore and practice speaking skills through meaningful projects, while AI functions as a lecturer-controlled technological support system. The integration of AI is relevant to the demand for deeper learning implementation as emphasized in Ministerial Regulation No. 13 of 2025, which encourages educators to utilize technology to enhance learning quality. Previous studies reveal that AI can create personalized, interactive, and adaptive learning experiences by generating learning materials, providing instant feedback, identifying students' learning patterns, and supporting teachers in designing effective instructional strategies (Badri & Susyla, 2025). Research on Large Language Models (LLMs) also confirms that AI contributes to improving learning accessibility, personalization, academic productivity, and language development, although ethical issues, data privacy, algorithmic bias, and teacher competence must be carefully considered (Guan et al., 2024). In speaking instruction, ChatGPT has been found to support students in developing linguistic aspects such as grammar, vocabulary, comprehension, and speaking content, while ELSA Speak assists learners in improving pronunciation and fluency through speech recognition and feedback features (Yiling et al., 2025. Furthermore, previous findings demonstrate that AI-supported learning can increase students' motivation, engagement, confidence, and learning independence while reducing speaking anxiety through flexible practice opportunities and immediate feedback (Tiwari, 2024; Qiao & Zhao, 2023; Nguyen, 2024). Therefore, the integration of AI into the PjBL framework represents an innovative pedagogical model for non-English study programs because it combines authentic project activities, technology-based feedback, and speaking performance assessment. AI supports students in preparing English content, practicing pronunciation, improving fluency, enriching vocabulary, and developing grammar accuracy, while the lecturer remains the main facilitator who ensures ethical implementation and alignment with learning objectives (Nugrahawati, 2024; Crompton et al., 2024; Fattah et al., 2023). The findings from previous studies confirm that AI-PjBL has strong potential to improve speaking performance by providing adaptive practice, collaborative learning experiences, and continuous formative feedback, enabling students to communicate more effectively in the target language (Darmawansah et al., 2025; Sayed et al., 2024; Dai & Wu, 2025). The researchers focus on the function of AI to drill speaking performance components.

Project-Based Learning

Project-Based Learning (PjBL) has become an innovative instructional model that supports English language learning by providing students with meaningful projects, collaborative activities, and authentic opportunities to use the target language. Previous studies indicate that PjBL can improve students' speaking performance by increasing motivation, creativity, confidence, and active participation in communication activities. Efriza and Fauzan (2024) found that PjBL

provides students with opportunities to practice speaking through project activities, while Tosun and Baris (2019) revealed that PjBL creates a more enjoyable and meaningful learning environment because students have greater opportunities to express themselves in English. Similarly, Herlina (2008) reported that PjBL enhances students' motivation, creativity, and speaking performance. In higher education contexts, Muhria et al. (2024) demonstrated that PjBL can be structured through its learning syntax to improve classroom management and encourage students to produce English projects, while Wangmo and Wang (2023) found that project activities help students develop English expression through written and oral communication. Furthermore, research by Wu and Meng (2010) and Abu Bakar et al. (2019) confirmed that PjBL also improves reading comprehension, interaction, intercultural communication, and students' engagement through project presentations and collaborative learning. Other findings show that PjBL contributes to developing professional communication skills, critical thinking, problem-solving abilities, and creativity across different educational fields (Canto et al., 2023). However, several studies also identify challenges in PjBL implementation, including the requirement for longer learning time, students' unequal language abilities, limited creativity, classroom management difficulties, and teachers' lack of preparation in designing project-based instruction (Hariyanto et al., 2024; Poonpon, 2017; Latifaj & Latifaj, 2023). Therefore, effective PjBL implementation requires careful planning, appropriate project design, teacher guidance, and consideration of students' English proficiency levels. Overall, previous findings confirm that PjBL is a suitable approach for English teaching, particularly for non-English study programs, because it promotes collaboration, learner autonomy, motivation, and continuous language practice while providing authentic contexts for improving speaking performance (Astawa et al., 2017; Kurniawati, 2023; Rambe & Suganda, 2023; Wang, 2023).

Speaking performance

It is considered a crucial dependent variable in English language learning, particularly for students in non-English study programs who often experience difficulties in fluency, pronunciation, vocabulary, grammar, and confidence. Previous studies have explored various strategies and technologies to overcome speaking challenges in EFL contexts. Al Mahmud (2022) found that technology-supported student-centered learning can improve speaking instruction by overcoming cultural barriers and providing more opportunities for students to practice English. Similarly, Verdiyeva and Huseynova (2017) demonstrated that communication learning strategies significantly improve students' fluency, vocabulary, and pronunciation while reducing speaking pauses. Li (2023) reported that blended learning strategies positively affect beginning learners' speaking performance by providing flexible and supportive learning environments, while Yusuf (2016) identified that limited pronunciation awareness, low motivation, and insufficient vocabulary are major problems affecting speaking development among non-English learners. Furthermore, Burns (2019) emphasized that successful speaking instruction should integrate essential components, including fluency, pronunciation, vocabulary, grammar, comprehension, and linguistic, sociolinguistic, and pragmatic competencies. Other studies confirmed that innovative approaches, such as Task-Based Language Teaching, dynamic speaking models, and technology-based materials, can enhance students' speaking accuracy, fluency, confidence, and interaction ability (Nopita, 2017; Pčolinská & Metruk, 2018; Traxler & Morton. (2016); Tomak, 2021). The findings also reveal that appropriate teaching materials, audio-visual resources, and culturally relevant strategies can support students in developing speaking skills by providing adaptive learning experiences (Nugroho & Nartiningrum, 2020; Beyer & Weichold ;2013); Bouzar, 2019). However, previous research indicates several challenges in speaking instruction, including limited classroom practice opportunities, teacher-centered learning, students'

anxiety, lack of vocabulary, pronunciation difficulties, and insufficient interaction during speaking activities (Potocek, 2017; Ahmed, 2018; Sari et al., 2023). Therefore, speaking performance improvement requires an innovative instructional model that combines appropriate teaching strategies, technology integration, authentic practice, and learner-centered activities to provide continuous opportunities for students to develop effective English communication skills

Research Method

This study employed a mixed-methods research design, combining qualitative and quantitative approaches to provide a more comprehensive understanding of the research questions than either method alone could offer, as affirmed by (Creswell, 2018), who argued that mixed methods yield deeper insights than single-method studies. The primary framework adopted was an exploratory sequential design consisting of three phases (Creswell, 2022; John, 2014): the first phase involved qualitative data collection and analysis through observation sheets, field notes, open-ended questionnaires, and semi-structured interviews to explore the preparation and implementation of Artificial Intelligence (AI) integrated into Project-Based Learning (PjBL) for speaking performance improvement; the second phase applied a quasi-experimental, non-equivalent one-group pre-test and post-test design to quantitatively measure the effectiveness of AI integration into PjBL, with data analyzed using descriptive statistics, normality tests, and non-parametric procedures via SPSS (Creswell & Creswell, 2018); and the third phase returned to qualitative inquiry to explore students' and lecturers' perceptions of the AI-integrated PjBL implementation. The variables in this study were structured into three categories: the independent variable was Project-Based Learning (PjBL), the mediating variable was the use of Artificial Intelligence tools , specifically ChatGPT and ELSA Speak, and the dependent variable was students' speaking performance. To ensure the validity and reliability of the findings, triangulation was applied through three strategies: data source triangulation involving both students and lecturers, method triangulation using multiple instruments including closed-ended and open-ended questionnaires, observation sheets, interviews, and score documents, and research triangulation through independent expert validation of instruments and inter-rater reliability checks (Creswell, 2018).

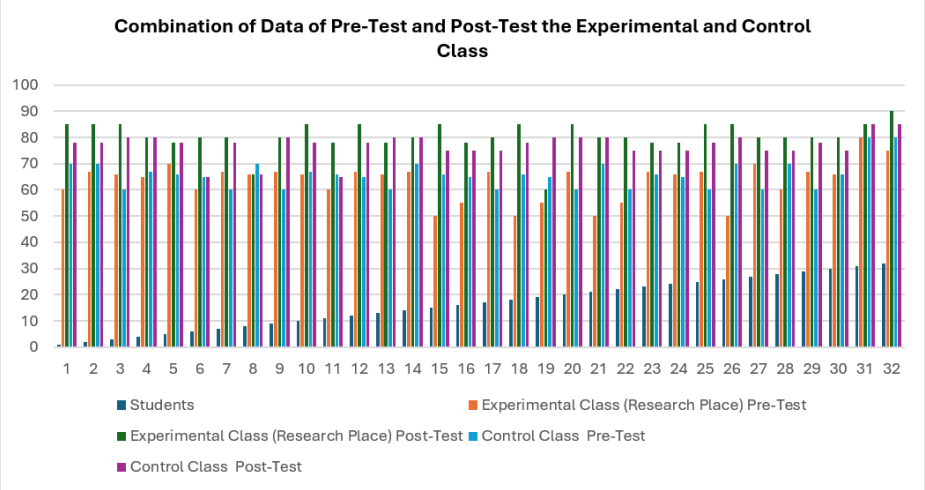
The research was conducted at a private Buddhist College in Central Java, with subjects consisting of 32 students in the experimental class and 32 students in the control class, all enrolled in the Buddhist Religious Education program with a focus on developing religious teaching competence; purposive sampling was employed to ensure that participants met the research criteria and could be placed in a single experimental group without external interference. In addition to students, two lecturers participated: the primary lecturer responsible for implementing the integration of AI into PjBL, and a second lecturer serving as an observer to strengthen the credibility and objectivity of the learning process data. Data collection was carried out through nine instruments: a document checklist adapted from Zou et al. (2023) to evaluate teaching preparation covering learning objectives, technology understanding, assessment, material selection, and infrastructure; an observation sheet adapted from Xiaofan and Annamalai (2025) to record lecturer and student engagement across all PjBL steps; open-ended questionnaires for both students and lecturers, inspired by Brown (2004), to gather in-depth experiential and perceptual data; a 13-item closed-ended Likert-scale questionnaire adapted from Creswell (2018) measuring students' perceptions of PjBL syntax and AI usage in the speaking class; semi-structured interviews to probe deeper into students' and lecturers' experiences; speaking score documents comprising pre-test and post-test results assessed by the lecturer using a rubric covering five components; vocabulary, fluency, pronunciation, grammar, and comprehension; each evaluated on a four-level scale ranging from Fair (40–55) to Very Good (86–100), adapted from Brown (2004) and Weir (2007); field notes recorded by the observer during implementation sessions; and reflection sheets documenting the lecturer's assumptions and evaluations throughout the

process. Qualitative data were analyzed thematically, while quantitative data from the pre-test and post-test speaking scores were processed using descriptive and inferential statistics via SPSS to evaluate the effectiveness of AI integration into PjBL in fostering students' speaking performance (Creswell, 2018).

Result

The Combination of Pre and Post Test in the Experimental Class and Control Class

The use of pre-tests and post-tests in both the experimental and control classes serve to accurately measure the effectiveness of AI integration into PjBL. By comparing initial scores before treatment and final scores after treatment across both classes, the researcher can determine whether improvements in students' speaking performance were genuinely caused by the AI-integrated PjBL approach or by other factors, thereby strengthening the validity, reducing bias, and deepening the understanding of cause-and-effect relationships in the research findings.



The data above can be seen that the comparison of pre-test and post-test scores between the experimental class and the control class where each consisting of 32 students who demonstrates a clear and significant difference in speaking performance improvement resulting from the AI-integrated PjBL treatment. Prior to the treatment, both classes showed relatively similar initial speaking performance scores ranging from 60 to 72 points, with most students scoring around 65 to 68, indicating that students in both groups had not yet optimally mastered speaking performance components, thus confirming the comparability of both classes as an appropriate baseline for experimental research. Following the implementation of AI into PjBL in the experimental class, students' scores increased substantially to a range of 70 to 90 points, with the majority scoring between 75 and 85, and some reaching as high as 90, reflecting an average improvement of approximately 10 to 15 points; notably, 29 out of 32 students surpassed the passing score, indicating that the treatment was largely successful across the class. In contrast, the control class, which did not receive the AI-integrated PjBL treatment that showed only a minimal improvement of approximately 5 to 8 points, with post-test scores ranging from 70 to 80, suggesting that without the specific treatment, students were unable to develop their speaking performance significantly. These findings confirm that the improvement observed in the experimental class was attributable to the integration of AI tools and PjBL, as the AI served as an effective drilling mediation and the project-based approach fostered student responsibility toward achieving learning objectives, thereby validating the effectiveness of AI integration into PjBL in fostering students' speaking performance

Based on classical statistics the quantitative data in this study were processed using SPSS to ensure accuracy and systematic interpretation. Descriptive statistics revealed that prior to the treatment, both the experimental and control classes demonstrated relatively similar speaking

performance levels, with the experimental class obtaining a mean pre-test score of 63.47 (ranging from 50 to 80) and the control class recording a mean of 65.78 (ranging from 60 to 80), confirming that both groups shared a comparable baseline before the intervention. Following the implementation of AI into PjBL, the experimental class showed a significant improvement, with the mean post-test score rising to 81.59 and the highest score reaching 90, reflecting an average gain of approximately 18 points; this improvement was attributed to the use of ChatGPT and ELSA Speak as drilling mediation tools alongside project-based collaboration. In contrast, the control class showed only a modest increase from a mean of 65.78 to 76.97, representing a gain of merely 11.19 points, which was considerably smaller than the improvement observed in the experimental class. To determine the appropriate statistical test for further analysis, a normality test using the Shapiro-Wilk method was conducted, and the results revealed that all four variables; experimental pre-test (sig. 0.002), experimental post-test (sig. 0.000), control pre-test (sig. 0.000), and control post-test (sig. 0.000), produced significance values below 0.05, indicating that the data were not normally distributed. Consequently, the null hypothesis of normal distribution was rejected, and the researcher shifted from parametric to non-parametric statistical tests, specifically the Wilcoxon Signed-Rank Test for within-group comparisons and the Mann-Whitney U Test for between-group comparisons, as scientifically justified alternatives that preserved the validity and reliability of the research findings.

To compare the speaking performance scores between the experimental class and the control class as two independent groups, the Mann-Whitney U Test was applied, as it does not require the assumption of normal data distribution and is therefore appropriate given the characteristics of the data obtained in this study. The results showed that the experimental class achieved a mean rank of 39.89 with a total sum of ranks of 1,276.50, substantially higher than the control class, which recorded a mean rank of 25.11 and a total sum of ranks of 803.50, clearly indicating that students in the experimental class performed significantly better in speaking than their counterparts in the control class. These findings were further confirmed by the Test Statistics results, which reported a Mann-Whitney U value of 780.50; reflecting a meaningful difference in the comparative ranking of scores between the two groups; alongside a Wilcoxon W value of 803.50 representing the lower-ranked control group's total, and a Z score of -3.72, whose negative sign and considerable distance from zero strongly indicated the direction and magnitude of the difference in speaking performance between the two groups. Most critically, the Asymp. Sig. (2-tailed) value was 0.000, which is far below the significance threshold of 0.05, leading to the rejection of the null hypothesis that there is no significant difference in speaking performance between the experimental and control classes. This statistical evidence conclusively demonstrates that the integration of AI tools, particularly ChatGPT and ELSA Speak, into Project-Based Learning had a significant and positive impact on students' speaking performance at the Buddhist College in Central Java, and that such improvement was not attributable to random or external factors but was directly caused by the treatment applied in the experimental class.

Integration of Speaking Teaching from Both of Qualitative and Quantitative Data

The quantitative results of this study provide strong statistical evidence that the integration of AI into Project-Based Learning (PjBL) significantly improved students' speaking performance at the Buddhist College in Central Java. Prior to the treatment, both the experimental and control classes demonstrated comparable baseline scores, with mean pre-test scores of 63.47 and 65.78 respectively, both categorized as "adequate" with notable weaknesses across all speaking components, including pronunciation, fluency, grammar, vocabulary, and content. Following the implementation of AI tools, specifically ChatGPT and ELSA Speak, within the PjBL framework, the experimental class recorded a remarkable

mean post-test score of 81.59, reflecting an improvement of approximately 18.12 points, while the control class showed a considerably smaller gain of only 11.19 points, rising from 65.78 to 76.97. The most transformative improvement was observed in the vocabulary dimension, where the number of students categorized as "good" surged dramatically from 3 to 20, and those in the "excellent" category increased to 11, while pronunciation and fluency also advanced from "fair" to "good" and "very good" levels through the repeated drilling facilitated by ELSA Speak. These improvements were further validated by the Mann-Whitney U Test, which produced an Asymp. Sig. (2-tailed) value of 0.000, well below the 0.05 significance threshold, alongside a mean rank of 39.89 for the experimental class compared to 25.11 for the control class, and a Z score of -3.72, collectively and conclusively confirming that the difference in speaking performance between the two groups was statistically significant and directly attributable to the AI-integrated PjBL treatment rather than to random or external factors.

The qualitative data gathered through student perceptions, lecturer reflections, observation sheets, open-ended questionnaires, and semi-structured interviews consistently revealed a positive and meaningful response to the implementation of AI in PjBL across all parties involved in the study. The majority of students expressed that AI tools such as ChatGPT and ELSA Speak were highly beneficial in helping them understand learning topics, develop project ideas, and independently practice all components of speaking skills in a structured and iterative manner; ChatGPT functioned as a cognitive partner that supported content development, vocabulary expansion, and grammatical sentence structuring, while ELSA Speak provided precise, instant, and personalized phonetic feedback that enabled students to engage in corrective and repetitive pronunciation practice cycles. The project design and speaking drilling activities were identified as the core pedagogical mechanisms driving the intervention's effectiveness, as they created optimal learning conditions where students were simultaneously exposed to rich linguistic input and given adequate opportunities to actively produce language output. Furthermore, the systematic scheduling and monitoring system was perceived positively by most students, who reported feeling more disciplined, consistent, and responsible in completing projects and conducting regular speaking practice sessions, while lecturer feedback throughout the process helped students identify specific weaknesses, make targeted corrections, and gradually build linguistic confidence. From the lecturer's perspective, the integration of AI into PjBL successfully transformed the learning environment from a passive and transmissive setting into an interactive, collaborative, and participatory ecosystem, which was particularly meaningful for students from non-English study programs who traditionally face greater psychological and linguistic barriers in developing speaking competence, and who, through adaptive AI facilitation and responsive lecturer guidance, were able to gradually overcome those barriers and develop into more confident, creative, active, and responsible learners.

The convergence of quantitative and qualitative findings in this study mutually reinforces and deepens the understanding of how and why the integration of AI into PjBL proved effective in fostering students' speaking performance, demonstrating that the 18.12-point improvement in the experimental class was not merely a statistical outcome but the product of a multidimensional synergy between functional AI technology, structured project-based learning design, formative monitoring, and a supportive collaborative environment. The positive perceptions reported by students in the qualitative strand are not simply affective responses but reflect a deeper cognitive awareness of the relevance and utility of AI tools, which, within the framework of learning motivation theory, functioned as a catalyst for intrinsic motivation, encouraging students to engage actively and independently in speaking practice beyond the formal classroom context, and thus directly contributing to the score trajectory documented in the quantitative data.

The structural support system surrounding the AI implementation, encompassing systematic scheduling that internalized discipline and accountability, ongoing lecturer monitoring that provided formative feedback, and collaborative project activities that fostered peer interaction and learning responsibility explains why the improvements in the experimental class were not only significantly greater than those of the control class by approximately 7 points, but were also more evenly distributed and consistent across all measured speaking components. Ultimately, the statistical confirmation provided by the Mann-Whitney U Test, with its Asymp. Sig. value of 0.000 and a substantially higher experimental class mean rank of 39.89, gains its fullest interpretive meaning when read alongside the qualitative evidence of transformed classroom dynamics, increased student motivation, and lecturer-observed growth in student confidence and creativity, collectively affirming that the success of this intervention is a holistic achievement rooted in the integration of technology, pedagogy, and human guidance working in concert.

Discussion

the findings of this study demonstrate that the integration of Artificial Intelligence (AI) tools, specifically ChatGPT and ELSA Speak into Project-Based Learning (PjBL) significantly improved students' speaking performance, as evidenced by the experimental class's mean score rising from 63.47 to 81.59, reflecting an 18.12-point gain compared to the control class's modest improvement of 11.19 points. This finding is consistent with previous research conducted by Fernandes, et al. (2024), who found that the use of AI-based tools in English language learning effectively enhanced students' speaking fluency and pronunciation accuracy, particularly among non-English major students who typically face greater linguistic and psychological barriers. Similarly, Hùng (2024) confirmed that AI-assisted language learning environments provide personalized, immediate, and corrective feedback that accelerates the acquisition of speaking components more efficiently than traditional classroom instruction alone. The role of ELSA Speak as a pronunciation drilling tool in this study aligns with the findings of Isaee and Barjesteh (2025)., who demonstrated that technology-mediated pronunciation practice enables learners to engage in self-directed corrective cycles that lead to measurable improvements in phonetic accuracy and prosodic features. Furthermore, the use of ChatGPT as a cognitive scaffolding tool for content development and grammatical structuring resonates with the argument of Mai and Hanh (2024), who asserted that generative AI functions as an effective language partner capable of supporting vocabulary expansion, discourse organization, and communicative competence development in EFL contexts. The statistically significant result of the Mann-Whitney U Test, yielding an Asymp. Sig. (2-tailed) value of 0.000 with a mean rank difference of 39.89 versus 25.11 between the experimental and control classes, conclusively validates that the observed improvement was directly attributable to the AI-integrated PjBL treatment rather than to incidental or external variables, thereby reinforcing the scientific credibility of this intervention as an effective pedagogical strategy for speaking performance enhancement.

This finding supports the theoretical position of Thomas (2019), who established that PjBL promotes deeper learning engagement by requiring students to collaborate, communicate, and produce tangible outcomes that are directly connected to real-world communicative tasks, thereby creating authentic conditions for language use that are rarely replicated in conventional instructional settings. In the context of this study, the project-based activities required students to design, rehearse, and present speaking projects such as promoting study programs, which compelled them to actively integrate all speaking components, including pronunciation, fluency, vocabulary, grammar, and content, within a single, unified communicative performance. This is consistent with the findings of Hoesny, et al. (2024), who argued that PjBL in EFL classrooms significantly increases students' willingness to communicate and reduces foreign language anxiety by providing structured yet

flexible learning spaces where students feel a genuine sense of ownership and purpose over their linguistic production. The qualitative data in this study further corroborate this mechanism, as students reported feeling more disciplined, responsible, and motivated to practice speaking consistently as a result of the project design and systematic scheduling embedded within the PjBL framework, a phenomenon that aligns with the self-determination theory proposed by Deci and Ryan (2000), which posits that structured autonomy and relevance in learning tasks are key predictors of intrinsic motivation and sustained effort. Moreover, the lecturer's reflective data confirmed that the collaborative and participatory nature of the PjBL environment transformed the classroom from a passive, teacher-centered space into an interactive learning community, which is precisely the condition that Beckett and Slater (2005) identified as optimal for developing communicative competence in second language learners, as it replicates the social and collaborative dimensions of authentic language use.

This dual-support mechanism reflects the blended feedback model described by Hùng . (2024), who argued that the most effective technology-enhanced language learning environments are those in which digital tools and human instructors play complementary rather than competing roles, with technology providing immediate corrective feedback at the micro-level of phonetics and grammar while human educators address the macro-level dimensions of communicative purpose, discourse coherence, and affective engagement. In this study, ELSA Speak fulfilled the micro-level function by delivering precise, instant, and personalized phonetic feedback on every utterance, enabling students to engage in repeated corrective practice cycles that gradually internalized accurate pronunciation patterns, a process consistent with the skill acquisition theory of Hoesny, et al. (2024), which posits that repeated proceduralized practice under corrective conditions is the primary mechanism through which declarative linguistic knowledge is transformed into automatic communicative performance. Meanwhile, lecturer monitoring provided the formative dimension of the feedback system, enabling students to identify specific areas of weakness, receive targeted guidance, and build the metacognitive awareness necessary for self-regulated speaking improvement, which corresponds with the findings of Hoesny, et al. (2024), who identified formative feedback as one of the most powerful influences on learning outcomes across educational contexts. The qualitative perception data collected from students in this study consistently highlighted that the combination of AI-generated feedback and lecturer guidance made the learning process feel simultaneously independent and supported, a balance that fostered both linguistic confidence and communicative risk-taking, two dimensions that Krashen (2004) identified as essential prerequisites for meaningful language acquisition through his affective filter hypothesis, which asserts that learners acquire language most effectively when anxiety is reduced and motivation and confidence are high.

The fact that 29 out of 32 students in the experimental class surpassed the passing score threshold following the AI-integrated PjBL intervention demonstrates that this approach is not only statistically effective but also practically inclusive, as it accommodates the diverse linguistic starting points and learning paces of students who do not specialize in English, a finding that resonates with the argument of Azamatova, et al. (2023), who contended that technology-mediated language instruction is particularly beneficial for learners with limited access to authentic communicative contexts, as it democratizes opportunities for meaningful language practice regardless of linguistic background or proficiency level. Furthermore, the transformative shift in the vocabulary dimension, from 3 students in the "good" category to 20, with an additional 11 reaching "excellent" where it reflects the lexical development potential of AI-mediated input, supporting the vocabulary acquisition framework of Amelia, et al. (2022), who emphasized that meaningful, repeated, and contextualized encounters with target vocabulary are the most

reliable conditions for deep lexical learning, conditions that ChatGPT's conversational scaffolding and ELSA Speak's contextualized pronunciation feedback collectively provided throughout the intervention. The qualitative evidence of increased student confidence, creativity, and active participation further suggests that the psychological transformation accompanying the linguistic improvement is equally important, as it aligns with the findings of Amirovich, (2021), who demonstrated that positive classroom emotions and reduced foreign language anxiety are not merely byproducts of successful language learning but are themselves active contributors to communicative development and long-term language retention. Taken together, these findings advocate strongly for the systematic incorporation of AI tools within structured pedagogical frameworks such as PjBL in higher education English teaching, particularly for non-English major students, and call upon curriculum designers, language educators, and institutional policymakers to recognize AI-integrated project-based learning not as a supplementary novelty but as a transformative core instructional strategy capable of fostering comprehensive, sustainable, and meaningful speaking competence development across diverse educational contexts.

The findings of this study offer substantial contributions to the broader discourse on English language teaching for international students, particularly those who navigate the dual challenge of acquiring academic English proficiency while simultaneously adapting to culturally and linguistically unfamiliar educational environments. International students, by definition, face a uniquely complex constellation of communicative demands that extend far beyond the classroom, encompassing academic presentations, cross-cultural interactions, professional networking, and daily social communication, all of which require a high degree of speaking competence that conventional instructional methods have consistently struggled to develop adequately within the constraints of formal academic schedules (Anjarani, et al., 2024). The AI-integrated PjBL approach demonstrated in this study directly addresses this gap by providing international students with a flexible, self-directed, and technologically mediated practice environment that transcends the temporal and spatial boundaries of traditional classroom instruction, enabling them to engage in meaningful speaking practice at any time and in any context through tools such as ChatGPT and ELSA Speak. This aligns with the findings of Astawa, et al. (2017), who argued that international students benefit disproportionately from AI-assisted language learning environments because such tools offer a psychologically safe space for repeated communicative practice without the social judgment and evaluative anxiety that often inhibit speaking performance in multicultural classroom settings. Furthermore, the project-based dimension of the intervention is particularly relevant for international students, as it mirrors the collaborative, outcome-oriented academic tasks they are expected to perform in international higher education contexts, thereby simultaneously developing their linguistic competence and their academic cultural literacy, a dual outcome that Bellot, et al. (2025) identified as the most critical factor determining international students' academic success and social integration in host institutions. The dramatic improvements observed across all speaking components in the experimental class of this study, including a vocabulary improvement from 3 to 20 students in the "good" category and an overall mean score gain of 18.12 points, suggest that when AI tools are embedded within a structured and monitored pedagogical framework, they can serve as powerful equalizers that accelerate the speaking development of linguistically diverse learners, including international students who enter higher education with varying degrees of English proficiency but share the common need for contextualized, corrective, and confidence-building communicative practice.

Conclusion

The findings of this study conclude that the integration of Artificial Intelligence (AI), particularly ChatGPT and ELSA Speak, into Project-Based Learning (PjBL) significantly

improved students' speaking performance. The quantitative results demonstrated that students who participated in the AI-integrated PjBL approach experienced a substantially higher improvement compared to those who received conventional learning methods. The experimental class showed an increase in the mean score from 63.47 in the pre-test to 81.59 in the post-test, representing an improvement of 18.12 points, while the control class only increased from 65.78 to 76.97. The statistical analysis confirmed that the difference between the two groups was significant, indicating that the improvement in the experimental class was strongly associated with the implementation of AI-integrated PjBL. Therefore, AI integration within a structured project-based learning environment proved to be an effective instructional approach for enhancing students' speaking competence. It is recommended that English lecturers integrate AI tools such as ChatGPT and ELSA Speak within Project-Based Learning to enhance students' speaking performance through structured, interactive, and meaningful practice. Institutions are also encouraged to support this implementation by providing adequate training and digital facilities, while students should use AI responsibly as a learning aid to develop independent and continuous speaking practice.

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