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Aartificial Intelligence and Teacher Collaboration in Enhancing English Fluency: Evidence from EFL Vocational Schools Learners

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Abstract

This study explores the challenges of enhancing English fluency among students at vocational high schools and evaluates the potential of integrating artificial intelligence (AI) tools with teacher collaboration as a strategy for improvement. In a region marked by limited teaching resources, geographical isolation, and a shortage of qualified educators, traditional English instruction often fails to meet students' communicative needs. The research aimed to determine whether the combined use of AI-based interventions and collaborative teaching practices could yield more effective outcomes in speaking fluency compared to conventional methods. Utilizing a quasi-experimental design without random assignment due to logistical constraints, the study involved 200 participants from five vocational schools. Data were collected through surveys and in-depth interviews. Quantitative analysis, using independent t-tests and ANOVA, revealed a statistically significant improvement in fluency scores for the experimental group. Pre-test mean scores were 18.2 (experimental) and 17.9 (control), while post-test scores increased to 24.5 and 20.1, respectively, with Cohen's d values indicating a strong effect (1.21 for experimental, 0.42 for control). Qualitative findings showed that students developed greater confidence and motivation, influenced by the interactive and adaptive features of AI, while teachers reported increased instructional alignment through collaborative efforts. The study concludes that integrating AI tools with teacher collaboration creates a supportive, engaging, and effective environment for developing fluency. It recommends broader implementation of such models in similar educational contexts and suggests future research focus on long-term impacts and sustainable strategies for embedding AI in teacher training and classroom practices.

Keywords: Artificial intelligence; Teacher collaboration; English fluency; English instruction

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INTRODUCTION

Low English fluency among vocational high school (SMK) students in Indonesia poses a significant barrier to workforce readiness, limiting their employability in globalized industries that demand strong language competencies (Ahmad et al., 2018). This issue is particularly pronounced in regions like East Lombok, where geographical isolation and limited educational resources exacerbate disparities in language education quality (Balkibekov et al., 2021). Schools in such areas often lack qualified English teachers, access to digital tools, and opportunities

for immersive language practice, further entrenching inequities in student outcomes. As Indonesia seeks to align its vocational education system with Industry 4.0 demands, addressing these systemic challenges is critical to ensuring equitable workforce preparedness (Srinivasan, 2022).

Recent advancements in artificial intelligence (AI) have revolutionized language learning, offering promising solutions to address resource gaps in underserved regions. AI-driven tools, such as speech recognition software, adaptive learning platforms, and intelligent tutoring systems, have been shown to enhance language acquisition by personalizing instruction and providing immediate feedback (Chai et al., 2023; Hwang et al., 2018). For instance, studies demonstrate that AI-powered chatbots and automated writing evaluation systems improve students' speaking and writing skills while reducing anxiety (Ouyang et al., 2022; Karpova, 2020).

Parallel developments in teacher collaboration models, such as co-teaching and professional learning communities (PLCs), have also gained traction in education (Johnson & Martinez, 2022). These frameworks emphasize shared responsibility and continuous professional development to optimize instructional practices (Chai et al., 2017; Hodgson et al., 2022). However, studies on the integration of AI with teacher collaboration in language education remains limited, particularly in vocational settings. While AI technologies are increasingly adopted in higher education to supplement traditional teaching (Estes et al., 2021), their application in Indonesian vocational schools has been underexplored.

Despite the potential of AI to address resource constraints in language education, studies examining AI-teacher collaboration in Indonesian vocational contexts are scarce. Existing study primarily focuses on AI's standalone applications or teacher collaboration in non-technology settings (Kim et al., 2020; Jin et al., 2023). This gap is significant, as vocational education in Indonesia requires context-specific solutions that align with students' career-oriented learning needs. The present study aims to fill this void by exploring how AI tools and teacher collaboration models can synergize to improve English fluency among SMK students in resource-limited regions like East Lombok.

This study represents the first empirical investigation of AI-teacher collaboration to enhance English fluency among vocational high school (SMK) students in East Lombok, Indonesia (Rahmawati et al., 2020). Prior study has explored AI integration in language learning (e.g., automated writing evaluation tools, speech recognition) and teacher collaboration models (e.g., co-teaching, professional learning communities) independently (Karpova, 2020; Hodgson et al., 2022). However, no study has systematically examined their synergistic impacts in Indonesian vocational education, particularly in resource-constrained regions like East Lombok. This gap is critical, as vocational students in such areas face compounded challenges of low fluency and limited access to qualified teachers or digital tools (Williyan et al., 2024).

This study addresses two key research questions: Can AI tools (e.g., speech recognition, adaptive learning platforms) improve students' English fluency more effectively than traditional teaching methods? And Can teacher collaboration models (e.g., co-teaching, PLCs) enhance the effectiveness of AI tools in language learning? Thus, the primary purpose of this study is to evaluate the combined impact of AI tools and teacher collaboration on English fluency among SMK students in East Lombok. Through addressing this gap, the study aims 1) to provide actionable

insights for policymakers and educators seeking to leverage technology and 2) collaborative pedagogies to improve workforce readiness in underserved regions.

RESEARCH METHOD

Research Design

This study utilizes a quasi-experimental design featuring pre-test and post-test assessments to examine the effectiveness of integrating artificial intelligence (AI) tools with teacher collaboration in improving English speaking fluency among vocational high school (SMK) students. As Creswell (2014) explains, quasi-experimental designs involve the application of treatments or interventions, but unlike true experiments, they do not include random assignment of participants to groups. This methodological choice is often necessitated by real-world limitations, such as working within existing classroom settings or school administrative constraints, which make randomization impractical or impossible.

In the context of this research, the decision to employ a quasi-experimental approach stemmed from logistical and ethical considerations. Specifically, schools and classes in East Lombok were already formed and managed according to fixed schedules and structures, making it unfeasible to randomly assign students to different intervention groups. This limitation is common in educational settings and aligns with research in educational technology that has successfully employed quasi-experimental designs under similar constraints (Dai & Wu, 2023).

To maintain methodological rigor despite the absence of randomization, participants were stratified by school and then assigned to either the experimental group (receiving AI-teacher collaborative instruction) or the control group (receiving traditional instruction), based on their pre-existing class groupings. Pre-test and post-test assessments were administered to both groups to measure changes in English fluency, allowing for a controlled comparison of outcomes. This approach helped mitigate initial disparities in language proficiency and supported a more accurate evaluation of the intervention's effectiveness. The design choice reflects established practices in educational research, as supported by scholars such as Hodgson et al. (2022), Johnson and Christensen (2021), and Sari and Wijaya (2021), who emphasize the utility of pre-/post-test designs for capturing learning gains in non-randomized educational interventions.

Participants

The study involved 200 students aged 16 to 18, drawn from five vocational high schools (SMK) located in East Lombok, Indonesia. These schools were intentionally chosen to reflect a range of geographic areas and to represent the common educational challenges in the region, such as limited access to qualified English teachers and technological resources. Participants came from diverse backgrounds and varying levels of English proficiency, allowing for a more comprehensive understanding of the intervention's effectiveness across different learner profiles. Students were equally divided into two groups: an experimental group (n = 100), which received instruction through AI-assisted and teacher-collaborative methods, and a control group (n = 100), which continued with traditional teaching approaches. To ensure fairness and validity in the grouping process, stratified sampling was employed. This method distributed students across both groups in a way that preserved demographic and proficiency-level parity, minimizing the risk of selection bias (Chai et al., 2023). Prior to data collection, ethical clearance was obtained from local educational authorities, affirming compliance with institutional and regional research standards. Additionally,

informed consent was collected from both the students and their legal guardians, ensuring voluntary participation and understanding of the study's goals and procedures. This ethical and methodologically rigorous approach ensured the reliability and integrity of the participant selection process.

Intervention

Students received AI-enhanced instruction using tools such as Duolingo (for adaptive vocabulary and grammar practice) and speech recognition apps (e.g., Google Speech-to-Text) to improve pronunciation and fluency. Teachers participated in workshops on AI integration and co-planned lessons with researchers, aligning with collaborative models like professional learning communities (PLCs) (Hodgson et al., 2022). AI tools were integrated into 60% of class activities, with teachers providing real-time feedback via AI-generated analytics. Students received traditional instruction focused on textbook-based lessons, teacher-led drills, and rote memorization. No AI tools or collaborative teacher training were implemented. Fluency was assessed via standardized oral proficiency tests (pre/post) scored by certified raters using the IELTS Speaking Band descriptors.

Quantitative data on student performance and engagement were supplemented with qualitative surveys on perceived AI utility and teacher collaboration efficacy. Mixed-effects regression models will compare fluency gains between groups, controlling for covariates like baseline scores and school-level factors. Hypotheses will be tested using ANOVA, with effect sizes reported as Cohen's *d*. Qualitative data will be thematically analyzed to triangulate findings (Chen et al., 2023).

Data Collection

To measure English speaking fluency, the study employed standardized assessments, with a focus on the TOEFL iBT Speaking section. This test was administered as both a pre-test and post-test to capture changes in students' fluency over the course of the intervention. All speaking responses were rated by certified evaluators using the official TOEFL iBT Speaking rubric, which provides criteria consistent with the CEFR (Common European Framework of Reference for Languages), ensuring internationally recognized benchmarks for language proficiency (Educational Testing Service, 2023). In addition to performance scores, quantitative data included engagement metrics collected through digital platforms, such as time spent using AI-based tools, frequency of task completion, and interaction logs. These behavioral indicators provided additional context for evaluating the effectiveness and usability of the intervention. All quantitative data were processed and statistically analyzed using SPSS version 28 to determine significance levels and effect sizes.

To complement quantitative findings, qualitative data were collected through surveys and interviews. The surveys, adapted from Fathi et al. (2024), assessed both students' and teachers' perceptions of AI integration and collaborative teaching methods, focusing on aspects such as perceived usefulness, ease of implementation, and willingness to adopt. Furthermore, semi-structured interviews were conducted with 20 participants to explore deeper insights into user experiences, including benefits like personalized learning support and increased confidence, as well as obstacles such as technical limitations and initial resistance to technology. Interview data were analyzed using Braun and Clarke's (2006) thematic analysis framework, allowing researchers to identify recurring patterns and emergent themes that enriched the overall interpretation of the study's findings.

Data Analysis

To evaluate the effectiveness of the intervention, the study employed a series of quantitative statistical analyses. Pre-test and post-test fluency scores from both the experimental and control groups were compared using independent t-tests, which allowed for assessing whether the observed improvements in speaking fluency were statistically significant between the two instructional approaches. To further examine the influence of the dual intervention—AI tools and teacher collaboration—on learning outcomes, an Analysis of Variance (ANOVA) was performed. This enabled the identification of interaction effects between the two variables and their combined impact on students' fluency development. To assess the practical significance of the results, effect sizes were calculated using Cohen's d, and 95% confidence intervals were established to determine the precision of the estimates. All statistical tests were conducted using SPSS version 28, with the threshold for statistical significance set at $\alpha = 0.05$.

In parallel, qualitative data were analyzed using thematic analysis based on Braun and Clarke's (2006) six-phase model. Data from surveys and semi-structured interviews were systematically coded and categorized using NVivo software, which supported iterative analysis. Emerging themes included "AI-driven motivation," reflecting students' engagement with personalized digital tools, and "teacher-AI co-planning challenges," highlighting implementation difficulties. The study applied data triangulation by integrating qualitative and quantitative findings, ensuring methodological rigor and enhancing the credibility of the results. This alignment with mixed-methods research principles allowed for a more comprehensive and nuanced understanding of how AI and teacher collaboration collectively influenced English fluency among SMK students.

RESULTS AND DISCUSSION

Students' Fluency Improvement

The experimental group demonstrated a 30% higher improvement in English fluency compared to the control group ($p < 0.05$), as measured by pre-test/post-test TOEFL iBT Speaking scores. Table 1 and Figure 1 below summarize the results:

Table 1. Fluency Scores (Mean ± SD) by Group

Group	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Difference (95% CI)	Effect Size (Cohen's *d*)
Experimental	18.2 (2.4)	24.5 (3.1)	6.3 (5.2–7.4)	1.21
Control	17.9 (2.6)	20.1 (2.9)	2.2 (1.5–2.9)	0.42

The results support H1 and H2, confirming that AI tools combined with teacher collaboration significantly enhance fluency outcomes. The experimental group's effect size (Cohen's $d = 1.21$) indicates a large practical impact, aligning with meta-analytic findings that AI-driven interventions yield high effect sizes ($g = 0.812$) in language learning. Specifically, AI tools like speech recognition apps provided immediate, personalized feedback, addressing gaps in traditional instruction.

Teacher collaboration further amplified AI's effectiveness. Co-planned lessons and workshops enabled teachers to integrate AI tools into curricula, fostering student engagement and reducing resistance to technology. This aligns with studies emphasizing AI's role as a "complementary tool" rather than a substitute for human instruction.

While the study demonstrates AI-teacher collaboration's efficacy, limitations include the quasi-experimental design and short intervention duration (8 weeks). Future research should explore long-term impacts and scalability in diverse

vocational settings. Additionally, mixed-methods approaches could further elucidate how AI tools address affective barriers (e.g., anxiety) in language learning.

Student Perspectives

Qualitative data from surveys and interviews revealed that 85% of experimental group students reported increased confidence in speaking English, attributing this to AI tools' instant feedback. For example, one student stated: "The speech recognition app tells me exactly where I mispronounce words, so I can fix it right away. I feel more confident now" (Student Interview #12). This aligns with meta-analytic findings that AI-driven feedback enhances learner self-efficacy (g = 0.78) in language tasks.

Teacher Perspectives

Teachers emphasized that **collaborative lesson planning** was critical to AI integration. During interviews, 90% of experimental group teachers noted that co-planning workshops helped them align AI tools with curriculum goals. One teacher stated: "Without the workshops, I wouldn't know how to use Duolingo for grammar drills. Collaboration made the tools feel like extensions of my teaching" (Teacher Interview #5). This finding supports prior research on professional learning communities (PLCs), which show that teacher collaboration improves technology adoption in classrooms.

Table 2. Qualitative Themes and Supporting Evidence

Theme	Supporting Evidence	Reference
AI Feedback Boosts Confidence	85% of students cited instant feedback as key to fluency gains.	Xu & Wang, 2024
Collaborative Planning Key	90% of teachers highlighted workshops as essential for AI integration.	Hodgson et al., 2022

The qualitative findings of this study provide strong support for both research hypotheses (H1 and H2), complementing and reinforcing the quantitative data that demonstrated significant improvements in students' English fluency. The students' increased confidence in speaking English is closely linked to the affective benefits offered by AI tools, particularly in reducing common emotional barriers such as fear of making mistakes or speaking in public. The instant and personalized feedback provided by AI technologies helped learners feel more in control of their progress, promoting a sense of competence and self-efficacy. This emotional reassurance plays a critical role in language learning, especially in oral communication, where anxiety often impedes performance. On the other hand, the teachers' consistent emphasis on collaborative planning and instructional alignment illustrates the irreplaceable human element in language education. While AI tools are effective in delivering tailored linguistic input, they cannot independently adapt to the nuanced dynamics of classroom culture, student diversity, or evolving learning needs. Thus, these findings affirm the importance of a human-AI partnership model. However, it is important to acknowledge that the qualitative data were self-reported through interviews and surveys, which may introduce subjectivity or social desirability bias. Future research should adopt longitudinal and mixed-methods designs to assess the long-term impact of AI integration on student confidence, fluency, and intrinsic motivation in varied vocational education contexts.

Discussion

The findings of this study provide compelling evidence that the integration of artificial intelligence (AI) tools with teacher collaboration significantly enhances English fluency among vocational high school (SMK) students in resource-constrained settings. The quantitative results revealed that the experimental group, which received AI-assisted instruction coupled with collaborative teaching strategies, demonstrated greater improvements in fluency compared to the control group receiving traditional instruction. The effect size of Cohen's d = 1.21 indicates a substantial practical impact, suggesting that the intervention is not only statistically significant but also meaningful in real-world teaching contexts.

One key driver of this improvement was the use of AI-driven applications, such as speech recognition software and adaptive language learning platforms. These tools enabled personalized, immediate feedback, allowing students to identify and correct pronunciation errors in real time. This aligns with previous research indicating that AI-mediated feedback enhances self-monitoring, reduces speaking anxiety, and fosters more autonomous learning behaviors (Xu & Wang, 2024; Fathi et al., 2024). Unlike static textbook-based instruction, AI technologies adapt to individual learner profiles, thereby supporting differentiated instruction even in large classrooms.

Importantly, the study also underscores the role of teacher collaboration in maximizing the pedagogical value of AI tools. Teachers who engaged in joint lesson planning and participated in professional learning workshops reported greater confidence in using AI applications meaningfully within the curriculum. This collaborative planning process fostered instructional coherence, as educators shared strategies, aligned objectives, and tailored AI integration to meet specific classroom needs. These findings mirror the work of Hodgson et al. (2022) and Johnson & Martinez (2022), who emphasize that teacher collaboration is essential for effective technology integration, especially in contexts where digital literacy among educators varies.

From a sociocultural perspective, the synergy between human teachers and AI technologies created a more interactive and supportive classroom environment. Students were not left to navigate AI platforms in isolation; instead, teachers mediated their learning experience by interpreting AI-generated data, addressing misconceptions, and providing human guidance. This hybrid model—where AI acts as a tool and teachers as facilitators—echoes the broader vision of human-AI symbiosis in education (Chai et al., 2023; Ji et al., 2023). The pedagogical strength of this model lies in its ability to balance technological efficiency with emotional and contextual responsiveness—elements that AI alone cannot replicate.

Qualitative data reinforced these observations. Students reported higher levels of engagement, motivation, and confidence, particularly due to the immediacy and clarity of feedback provided by AI. Many expressed that they felt more in control of their learning and more willing to take risks in speaking. These affective benefits are crucial in EFL learning, where anxiety and fear of error often inhibit oral communication. Furthermore, students appreciated the interactive nature of AI tools, noting that features like gamified exercises and speech tracking made the learning process more dynamic. This reflects findings from Huang et al. (2024) and Ouyang et al. (2022), who argue that AI-supported environments contribute to a low-stress learning context.

Teachers also noted shifts in classroom dynamics. The use of AI tools encouraged students to become more self-directed and reduced over-reliance on the teacher for correction. Additionally, collaboration among teachers improved not only their confidence in implementing new technology but also their willingness to adopt learner-centered practices. This shift is particularly noteworthy in vocational education, where

rigid, exam-oriented instruction often dominates. The findings thus indicate that AI-teacher collaboration has the potential to transform not only student outcomes but also instructional cultures.

Despite these promising results, several challenges emerged. Technical barriers, such as inconsistent internet connectivity and limited access to digital devices, hindered the full utilization of AI tools. These infrastructural limitations are common in semi-urban and rural Indonesian schools and highlight the urgent need for policy-level investments in educational technology infrastructure (Mourad, 2023). In addition, some teachers initially resisted using AI due to unfamiliarity and fear of being replaced. However, ongoing support through workshops and peer mentoring helped address these concerns, suggesting that change management strategies are critical for the successful integration of technology.

Another limitation pertains to the study's quasi-experimental design and relatively short intervention duration (eight weeks), which may not capture long-term effects or sustained behavioral change. While the immediate gains in fluency are encouraging, future studies should investigate whether these improvements persist over time and transfer to real-world communication contexts. Furthermore, the study relied on self-reported qualitative data, which may be subject to bias. Incorporating classroom observations and longitudinal follow-ups would strengthen the reliability of future findings.

This study contributes to the growing body of literature supporting blended pedagogical models that combine digital innovation with human collaboration. By situating AI within a framework of teacher co-planning and scaffolding, the research demonstrates how technological and pedagogical strengths can be mutually reinforcing rather than oppositional. The evidence from this intervention supports a paradigm shift in EFL instruction—one that embraces technological advancements while preserving the relational core of teaching and learning.

CONCLUSION

This study provides strong empirical support for the integration of artificial intelligence tools and teacher collaboration as an effective strategy to improve English fluency among vocational high school students in East Lombok, Indonesia. The quantitative findings reveal significant gains in oral proficiency in the experimental group, while qualitative data highlight enhanced student confidence, motivation, and teacher efficacy. Together, these results demonstrate the pedagogical value of combining AI-driven feedback with human instructional guidance. The hybrid approach creates a more engaging, personalized, and supportive language learning environment—especially important in underserved educational contexts. As such, the study recommends the scalable adoption of AI-teacher collaboration models in vocational education, supported by infrastructure investment, ongoing teacher training, and culturally responsive pedagogy. Future research should investigate the long-term sustainability of this approach, its impact on other language skills, and its applicability across different educational settings.

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