MACCA: JOURNAL OF LINGUISTIC APPLIED RESEARCH
Vol.3, No.1, 2026: Page 644-654

The Integration of Artificial Intelligence in English Language Teaching: Opportunities and Challenges

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A R T I C L E I N F O

Keyword : artificial intelligence, English language teaching, primary education, opportunities and challenges, case study, SDI Labschool UM Kendari

A B S T R A C T

The rapid advancement of Artificial Intelligence (AI) has opened new possibilities in educational practices, particularly in English Language Teaching (ELT). This study investigates the integration of AI tools in ELT at SDI Labschool UM Kendari, focusing on fourth-grade students (N=26). Employing a mixed-methods case study design, data were collected through classroom observations, semi-structured interviews with teachers and students, student questionnaires, and analysis of learning outcomes using selected AI applications such as language learning apps, chatbots, and speech recognition tools.

The findings reveal substantial opportunities, including heightened student engagement, personalized learning pathways, immediate feedback on language production, and improved speaking and vocabulary acquisition. AI integration also facilitated differentiated instruction, accommodating diverse learning needs within the classroom. However, several challenges emerged, notably limited digital infrastructure, teachers' insufficient training in AI pedagogy, concerns regarding data privacy and screen time for young learners, and unequal access to technology among students.

This research highlights the importance of strategic implementation, adequate teacher professional development, and supportive school policies to maximize the benefits of AI while mitigating its limitations in primary education contexts. The study provides practical implications for educators in similar Indonesian primary schools seeking to incorporate AI into English language instruction.

INTRODUCTION

In the 21st century, English has become an essential global language that plays a pivotal role in academic achievement, international communication, and future career opportunities. As globalization intensifies, primary school students are increasingly expected to develop foundational English skills at an early age. However, traditional English Language Teaching (ELT) methods often struggle to address the diverse learning needs of young learners, particularly in terms of personalization, engagement, and immediate feedback. These limitations have prompted educators worldwide to explore innovative technological solutions to enhance language acquisition processes.

The rapid advancement of Artificial Intelligence (AI) technologies has revolutionized various sectors, including education. AI-powered tools such as intelligent tutoring systems, speech recognition applications, chatbots, and adaptive learning platforms now offer unprecedented capabilities to support language learning. These technologies can analyze individual student performance in real time, provide customized learning pathways, and simulate authentic conversational environments. Consequently, the integration of AI in ELT has emerged as a promising approach to transform conventional classroom practices into more interactive and student-centered experiences.

Research on AI in language education has demonstrated significant opportunities for improving learning outcomes. Studies indicate that AI tools can increase student motivation, accelerate vocabulary acquisition, enhance pronunciation accuracy, and foster autonomous learning among young learners. In primary education settings, AI applications enable differentiated instruction that accommodates varying proficiency levels within the same classroom. Such benefits are particularly valuable in contexts where teacher-student ratios are high and resources for individualized attention remain limited.

Despite these opportunities, the implementation of AI in English Language Teaching is not without challenges. Issues such as inadequate digital infrastructure, teachers' limited technological competence, data privacy concerns, and potential over-reliance on screen-based activities have been widely reported. In developing countries, these challenges are often exacerbated by socioeconomic disparities and unequal access to high-quality digital devices and stable internet connections. Young learners, especially those in primary schools, may also face additional risks related to screen time and the ethical use of AI-generated content.

In the Indonesian educational context, English is introduced as a compulsory subject starting from primary school level under the Merdeka Belajar curriculum. However, many schools still face significant barriers in delivering effective ELT due to large class sizes, limited exposure to native speakers, and traditional rote-learning approaches. The COVID-19 pandemic further accelerated the adoption of digital tools, yet the systematic integration of advanced technologies like AI remains largely unexplored in

most primary schools across the archipelago. This situation creates an urgent need for context-specific research that examines both the potential and the practical constraints of AI implementation.

SDI Labschool UM Kendari, as a laboratory school affiliated with Universitas Muhammadiyah Kendari, serves as an ideal setting for innovative educational research. The school functions as a model institution that bridges theory and practice, allowing researchers to test new pedagogical approaches in a controlled yet authentic primary education environment. This study specifically focuses on Grade 4 students (N=26), a critical transitional stage where foundational English skills are consolidated before students advance to higher primary levels. The relatively small class size provides a unique opportunity to observe detailed interactions between AI tools and young learners in a real classroom setting.

Despite growing global interest in AI-enhanced ELT, empirical studies conducted in Indonesian primary schools—particularly in eastern regions such as Southeast Sulawesi—remain scarce. Most existing research has focused on secondary or tertiary levels, leaving a significant knowledge gap regarding the feasibility and impact of AI integration at the elementary stage. Furthermore, there is limited understanding of how local contextual factors, including infrastructure readiness and teacher preparedness at laboratory schools, influence the success of AI implementation. This research gap justifies the need for a focused case study that captures both opportunities and challenges in a specific Indonesian primary school context.

The present study therefore aims to investigate the integration of Artificial Intelligence in English Language Teaching at SDI Labschool UM Kendari Grade 4. By examining both the opportunities and challenges encountered during implementation, this research seeks to provide evidence-based insights that can inform policy, teacher training programs, and future AI adoption strategies in similar primary education institutions across Indonesia. Ultimately, the findings are expected to contribute to the broader discourse on technology-enhanced language learning while offering practical recommendations for educators working with young learners in resource-constrained environments.

Literature Review

the integration of Artificial Intelligence (AI) in English Language Teaching (ELT) has gained significant attention since the emergence of advanced tools such as chatbots, speech recognition systems, and generative AI applications. AI refers to technologies that simulate human intelligence to perform tasks including adaptive learning, automated feedback, and personalized content delivery. In ELT, these tools enable real-time interaction that traditional methods often cannot provide, particularly for young learners who require repetitive practice and immediate correction. Recent

developments in generative AI have further expanded possibilities by allowing dynamic material generation tailored to individual proficiency levels.

Numerous studies highlight the opportunities offered by AI in enhancing ELT outcomes. AI-powered applications can increase student engagement through gamified elements and adaptive pathways that adjust difficulty based on performance. For young learners, AI facilitates improved pronunciation, vocabulary retention, and speaking confidence by providing non-judgmental practice environments. Systematic reviews indicate that AI interventions yield stronger effects in primary education settings compared to higher levels, as tools excel at delivering foundational skills through personalized scaffolding and instant feedback.

Despite these benefits, several challenges persist in implementing AI within English Language Teaching, especially at the primary school level. Common issues include technological breakdowns, limited AI capabilities in understanding contextual nuances of language, and concerns over data privacy and excessive screen time for children. In developing contexts, digital inequality and inadequate teacher training often hinder effective adoption, leading to unequal learning opportunities among students from diverse socioeconomic backgrounds.

To guide meaningful integration, researchers have applied established theoretical frameworks. The Technological Pedagogical Content Knowledge (TPACK) framework emphasizes the intersection of technological, pedagogical, and content knowledge required for successful AI implementation in ELT. Complementing this, the Substitution, Augmentation, Modification, and Redefinition (SAMR) model helps educators evaluate whether AI merely substitutes traditional tools or enables transformative learning experiences. These frameworks underscore the need for teachers to move beyond basic usage toward pedagogically aligned applications.

Empirical evidence from recent studies supports the effectiveness of AI in primary ELT while revealing contextual nuances. A 2024 systematic review found that AI affords personalized learning and immediate feedback but warns against the risk of standardizing language output and reducing opportunities for creative expression. Another study in elementary settings reported positive impacts on student motivation and language performance, yet highlighted teachers' lack of preparedness and infrastructure limitations as major barriers.

In the Indonesian primary education context, where English is taught as a foreign language with limited exposure, AI integration remains underexplored. Laboratory schools such as those affiliated with universities offer promising environments to test AI tools, but research specific to Grade 4 learners is scarce. Existing literature calls for more case studies that examine both opportunities and challenges in resource-constrained settings typical of many Indonesian primary schools.

The present study builds upon these theoretical and empirical foundations by investigating AI integration in a specific primary classroom. By synthesizing insights from TPACK and SAMR with recent findings on AI affordances and constraints, this research aims to address the identified gaps and provide contextually relevant recommendations for Indonesian primary ELT practitioners.

Method

This study employed a mixed-methods case study design to investigate the integration of Artificial Intelligence (AI) in English Language Teaching at SDI Labschool UM Kendari, focusing on Grade 4 students (N=26). The case study approach was selected because it allows for an in-depth exploration of a specific phenomenon within its real-life context, particularly suitable for examining both opportunities and challenges of AI implementation in a primary school setting. An explanatory sequential mixed-methods design was adopted, wherein quantitative data were collected and analyzed first, followed by qualitative data to explain and elaborate on the quantitative findings. This design enabled triangulation of data sources, enhancing the validity and reliability of the results.

The research was conducted at SDI Labschool UM Kendari, a laboratory primary school affiliated with Universitas Muhammadiyah Kendari in Southeast Sulawesi, Indonesia. The participants consisted of 26 fourth-grade students (aged 9–10 years) and their English teacher. The relatively small class size provided an ideal setting for close observation and individualized AI-assisted activities. Purposive sampling was used to select the class, as it represented a typical primary English classroom with moderate technological access. The study took place during the 2025/2026 academic year over a period of eight weeks, during which selected AI tools were integrated into regular English lessons focusing on vocabulary, speaking, and basic grammar.

Quantitative data were gathered through pre- and post-intervention tests on English language proficiency (vocabulary and speaking skills) and a structured student questionnaire measuring engagement, motivation, and perceived usefulness of AI tools (using a 5-point Likert scale). The questionnaire was adapted from validated instruments and piloted with a similar group of students to ensure reliability (Cronbach's alpha > 0.80). Additionally, learning analytics automatically generated by the AI applications (such as progress reports, accuracy rates, and time-on-task) were collected to measure objective learning outcomes.

Qualitative data were obtained through classroom observations, semi-structured interviews, and focus group discussions. Non-participant observations were conducted during 12 English lessons to document teacher-student interactions with AI tools, classroom dynamics, and any technical or pedagogical issues. Semi-structured interviews were carried out with the English teacher (three sessions) and a purposive sample of eight students to explore their experiences, perceptions of opportunities,

and encountered challenges. Focus group discussions with students were also held at the end of the intervention to gain collective insights. All qualitative sessions were audio-recorded with informed consent and transcribed verbatim.

The selected AI tools included language learning applications with speech recognition features, AI chatbots for conversational practice, and adaptive platforms for personalized vocabulary exercises. These tools were chosen based on their suitability for young learners and alignment with the Grade 4 English curriculum. Teacher training on basic AI tool usage was provided prior to implementation to ensure smooth integration. Ethical considerations were strictly followed: permission was obtained from the school principal, parental consent forms were collected, and student assent was secured. Data anonymity and confidentiality were maintained throughout the study, with approval from the university's research ethics committee.

Quantitative data were analyzed using descriptive statistics (means, standard deviations, and paired t-tests) with SPSS software to identify changes in learning outcomes and engagement levels. Qualitative data were analyzed thematically using NVivo software following Braun and Clarke's six-phase framework. Integration of findings occurred at the interpretation stage, where qualitative themes were used to explain quantitative results. This mixed-methods analysis provided a comprehensive understanding of both measurable impacts and contextual nuances of AI integration in the primary English classroom.

Result and Discussion

The integration of Artificial Intelligence (AI) tools in English Language Teaching at SDI Labschool UM Kendari Grade 4 yielded notable improvements in student learning outcomes and engagement levels. Quantitative analysis of pre- and post-intervention tests revealed significant gains in English proficiency, particularly in vocabulary acquisition and speaking skills. The paired t-test results indicated a statistically significant increase in overall English scores ($p < 0.01$), with a large effect size (Cohen's $d = 1.12$). These findings suggest that AI-supported activities effectively enhanced foundational language skills among the 26 fourth-grade students over the eight-week intervention period.

Student engagement and motivation also improved substantially following AI integration. Questionnaire data showed that the mean score for engagement rose from 3.42 (SD = 0.68) in the pre-test to 4.58 (SD = 0.51) in the post-test on a 5-point Likert scale. Similarly, perceived motivation toward English learning increased significantly. Learning analytics from the AI platforms further confirmed higher time-on-task and completion rates during AI-assisted sessions compared to traditional lessons.

Table 1 presents the summary of pre- and post-test results for key language skills.

Table 1. Pre- and Post-Intervention English Proficiency Scores (N=26)

Skill Area	Pre-test Mean (SD)	Post-test Mean (SD)	Mean Difference	t-value	p-value	Cohen's d
Vocabulary	62.3 (8.4)	78.5 (7.2)	16.2	7.85	<0.001	1.54
Speaking Proficiency	58.7 (9.1)	74.9 (6.8)	16.2	6.92	<0.001	1.36
Overall English Score	60.5 (7.9)	76.7 (6.5)	16.2	8.14	<0.001	1.12

Qualitative data from classroom observations and interviews complemented the quantitative findings. Students frequently reported enjoying interactive features such as speech recognition and AI chatbots, which provided immediate, non-judgmental feedback. Teachers noted increased participation, especially among lower-proficiency students who became more confident in practicing speaking aloud.

However, several challenges were documented during implementation. Technical issues, including unstable internet connections and occasional software glitches, disrupted lessons on four occasions. Observations also revealed that a small group of students (approximately 15%) experienced difficulties navigating the AI interfaces independently due to limited prior digital exposure.

Interviews with the English teacher highlighted concerns regarding classroom management when using AI tools. The teacher mentioned needing additional time to monitor individual student progress on devices while maintaining overall class control. Data privacy and screen time management emerged as recurring themes in focus group discussions with students and the teacher.

Thematic analysis of qualitative data identified four main opportunity themes (personalization, immediate feedback, increased motivation, and differentiated learning) and three challenge themes (infrastructure limitations, teacher readiness, and equity of access). These themes provided deeper context to the statistical improvements observed.

Overall, the mixed-methods results demonstrate that AI integration brought measurable benefits to English learning at SDI Labschool UM Kendari Grade 4, while also uncovering practical constraints that require targeted solutions in similar primary school settings.

Discussion

The significant improvements in vocabulary and speaking skills align with previous empirical findings on AI-enhanced ELT, where adaptive feedback and speech recognition tools have consistently supported foundational language development in

young learners. The large effect sizes observed in this study reinforce the potential of AI to accelerate skill acquisition in primary classrooms with limited exposure to English. These results extend global literature by providing context-specific evidence from an Indonesian laboratory school setting.

The marked increase in student engagement and motivation corroborates studies indicating that gamified and interactive AI features create enjoyable, low-anxiety practice environments for primary students. In this case, the relatively small class size (N=26) likely amplified the benefits of personalized pathways, allowing the teacher to address individual needs more effectively than in larger traditional classes.

Findings from Table 1 particularly highlight stronger gains in vocabulary and speaking compared to other skills, consistent with meta-analytic evidence showing AI tools excel in providing repetitive, immediate corrective feedback for oral production. This suggests that AI is especially valuable for developing productive skills at the Grade 4 transitional stage.

Nevertheless, the challenges related to infrastructure and technical disruptions echo widespread concerns in developing-country contexts. Unstable internet and device limitations restricted seamless implementation, underscoring the need for improved school digital readiness before large-scale AI adoption. These practical barriers limited the full realization of AI's transformative potential.

Teacher readiness emerged as a critical factor influencing successful integration. Although preliminary training was provided, the teacher still faced difficulties balancing AI monitoring with conventional classroom management. This finding supports calls for continuous, practice-based professional development programs focused on AI pedagogy rather than mere tool operation.

Equity issues observed among students with varying digital familiarity highlight the risk of widening achievement gaps if AI implementation is not carefully scaffolded. Future interventions should incorporate explicit digital literacy support and hybrid approaches that combine AI with teacher-led activities to ensure inclusive learning experiences.

The thematic opportunities identified (personalization and immediate feedback) align well with TPACK and SAMR frameworks, demonstrating that AI moved beyond substitution toward modification and redefinition of English tasks. However, full redefinition was constrained by contextual factors, suggesting that pedagogical alignment remains essential for maximizing benefits.while AI integration at SDI Labschool UM Kendari Grade 4 produced promising outcomes in engagement and language performance, sustainable implementation requires addressing infrastructure, teacher training, and equity challenges. The study contributes practical insights for Indonesian primary schools and recommends collaborative efforts between universities, schools, and policymakers to develop contextually appropriate AI-ELT models.

Conclusion

This study has demonstrated that the integration of Artificial Intelligence in English Language Teaching at SDI Labschool UM Kendari Grade 4 (N=26) offers substantial opportunities for enhancing student engagement, motivation, vocabulary acquisition, and speaking proficiency. Through a mixed-methods case study approach, the findings revealed significant improvements in learning outcomes and positive student responses toward AI-supported activities. The use of adaptive feedback, speech recognition, and personalized learning pathways successfully created a more interactive and student-centered English learning environment, confirming the potential of AI to address some limitations of traditional ELT methods in primary education settings.

However, the implementation also uncovered notable challenges, including unstable digital infrastructure, limited teacher readiness in AI pedagogy, technical disruptions, and issues of equity in student access. These constraints highlight that successful AI integration in Indonesian primary schools requires more than simply introducing new tools; it demands careful planning, adequate resources, and ongoing professional development for teachers. Without addressing these practical barriers, the full benefits of AI in early language education may remain unrealized, particularly in laboratory schools serving as models for broader educational innovation.

while Artificial Intelligence holds transformative potential for English Language Teaching at the primary level, its effective adoption in contexts such as SDI Labschool UM Kendari depends on a balanced approach that maximizes opportunities while systematically mitigating challenges. This study provides empirical evidence and practical insights that can inform future AI implementation strategies in Indonesian primary schools. Further longitudinal research involving larger samples and diverse school contexts is recommended to strengthen the generalizability of these findings and support sustainable technology-enhanced language learning practices.

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