

Teachers' Perspectives on AI-Based Learning for Vocabulary Retention: Evidence from Indonesian Primary Schools

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Abstract

This research investigates the role of artificial intelligence (AI)-based technology in supporting vocabulary retention and enhancing student engagement in English language learning among Indonesian primary school learners. Employing a qualitative descriptive approach, data were gathered from seven primary school English teachers through open-ended questionnaires. A thematic analysis was employed to uncover the central patterns emerging from their responses. Findings indicate that AI-based learning tools, such as gamified applications and educational chatbots, play a pivotal role in enhancing students' vocabulary memorization by offering visual stimuli, instant feedback, and personalized learning experiences. Additionally, the integration of AI fosters greater student participation and motivation by making learning more interactive and engaging. Despite these benefits, several challenges were reported, including limited access to digital infrastructure, unstable internet connectivity, and insufficient teacher training in technology integration. Teachers also expressed concerns about the potential decline in students' social interaction due to overreliance on AI. Nevertheless, respondents conveyed optimism regarding AI's long-term potential to support adaptive and differentiated learning for young learners. The study enriches the existing body of scholarship in educational technology through the presentation of evidence obtained from primary-level classroom contexts. It also offers recommendations for stakeholders to address infrastructure and training gaps to ensure equitable and effective AI integration in language education. The implications are especially relevant as digital transformation policies in education gain momentum globally.

Keywords: *artificial intelligence, language learning, primary school, student engagement, vocabulary retention.*

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INTRODUCTION

Primary school students' performance in learning English as a foreign language was shaped by the level of their vocabulary mastery. Vocabulary competence is essential, as its absence hinders learners' ability to effectively engage in listening, speaking, reading, and writing (Nation, 2013; Schmitt, 2010). Vocabulary teaching requires serious attention in the English curriculum at the primary level. Primary school students tend to have limited memory, so

learning strategies that are easy to remember and interesting are needed to strengthen vocabulary retention. The efforts to improve vocabulary acquisition and maintenance have become the main focus in English teaching at the primary level.

Learning tools such as apps, chatbots, and educational games are generated by artificial intelligence (AI), which offers students instant feedback and a personalized learning experience. Studies suggest that AI can foster students' motivation and enhance vocabulary acquisition due to its interactive and adaptable features. (Hwang & Fu, 2020; Wang & Vasquez, 2021). Technology enables the implementation of personalized learning that accommodates the individual needs and learning pace of each student. Thus, the learning process becomes more effective. AI technology can create a fun learning environment and support active student engagement by using digital interaction features, images, and voice.

Current research focuses on teenagers or college students. This study examines the final exam scores more than the long-term memory or emotional engagement of primary school students. There are only a few studies investigating the effect of AI on primary school students' vocabulary retention in Indonesia (Xie et.al, 2019; Kohnke et.al, 2021). There are differences in learning characteristics, especially in terms of attention, motivation, and how to absorb information, between children, adolescents, and adults. Research is needed that prioritizes evaluating the real impact of using AI technology on primary school students' vocabulary retention. Therefore, this study aims to address this gap.

Previous studies on the integration of AI-based learning in language education have predominantly centered on adolescents and university students, with a primary focus on measurable academic outcomes such as examination performance and test scores. While these studies provide valuable insights, they often overlook the dimensions of long-term vocabulary retention and learner engagement, which are crucial for younger learners. Primary school students possess distinct cognitive and motivational characteristics that differ significantly from older learners, requiring approaches that not only enhance immediate performance but also sustain memory and interest over time. This study contributes by exploring Indonesian primary school teachers' perspectives on AI-based learning for vocabulary retention and engagement, a context rarely examined in current literature. By addressing this gap, the research offers a novel contribution to the field of educational technology and early language learning.

This study aims to investigate teachers' perceptions of how AI-based technology affects vocabulary retention and student engagement in English lessons in primary schools. Based on the gap with previous studies, the research question is to what extent the application of AI-based technology affects vocabulary retention and primary school students' engagement with English. A qualitative approach is used to explore the views of teachers as the main actors in implementing learning. The results of this study are expected to provide a real description of direct experience in the classroom.

The findings of this study are anticipated to offer practical contributions for teachers in implementing AI-based learning effectively, while also enriching academic perspectives on English vocabulary instruction in the digital era. The digital transformation policy for primary education announced by global institutions such as UNESCO (2024) is strengthened by the results of this study, by providing factual evidence from the field context. This study provides real recommendations for educational technology designers in developing child-friendly applications that are in line with the education curriculum in Indonesia. This study is expected to have an impact on English learning in primary schools to make it more relevant, adaptive, and enjoyable for students. Accordingly, this study addresses the following research question: To what extent does the implementation of artificial intelligence (AI)-based technologies affect primary school students' vocabulary retention and engagement with English?

LITERATURE REVIEW

Vocabulary acquisition is a fundamental component of second language learning and plays a decisive role in shaping students' ability to develop their listening, speaking, reading, and writing skills (Lin & Qian, 2019; Nation, 2013; NR et al., 2022). Without sufficient vocabulary knowledge, young learners may struggle to express their ideas clearly and to comprehend input in English. At the primary school level, this challenge is amplified because students are still at the early stage of cognitive development.

They require contextualized and engaging strategies to retain new words effectively (Cameron, 2001; Gordon & Lowry, 2024). Moreover, vocabulary mastery is strongly linked to overall academic success, as students with broader vocabulary knowledge tend to perform better in reading comprehension and literacy-related tasks (Alshehri, 2023; Stæhr, 2008). These observations highlight the pedagogical importance of vocabulary retention in early English education.

Vocabulary retention refers to learners' ability to store and recall new words over short and long periods, and it is a crucial indicator of the effectiveness of teaching methods (Numonova, 2024; Schmitt, 2010). Factors such as frequency of exposure, active use of vocabulary, and cognitive engagement significantly determine retention outcomes (Nation, 2001). Instructional strategies that integrate visual association, repetition, and meaningful practice enhance long-term retention (De Lima et al., 2021). Importantly, student motivation and affective involvement also play a central role in sustaining vocabulary knowledge. Research has shown that learners who are emotionally engaged tend to demonstrate higher retention and a stronger sense of ownership in the learning process (Rad & Alipour, 2025; Ushioda, 2011). These findings imply that vocabulary retention is not only a cognitive process but also a motivational and affective one.

The integration of AI-based technologies into English language learning has received growing attention due to their potential to personalize and diversify instruction. AI-driven applications, such as gamified platforms, chatbots, and virtual learning environments, offer adaptive feedback and tailor learning content according to learners' needs (Wang & Vasquez, 2021). Such tools create engaging learning atmospheres that encourage repeated practice and sustained interest, thereby supporting long-term retention (Hwang & Fu, 2020). Empirical studies have further demonstrated that AI integration leads to higher levels of vocabulary retention and student participation compared to traditional approaches (Zou et al., 2022). In addition, recent findings emphasize that AI-based gamification strategies, including digital escape rooms and quizzes, not only improve retention but also enhance learner motivation and collaborative engagement (Rad & Alipour, 2025). Hence, AI-based learning emerges as a promising approach to bridge the gap between engagement and sustainable vocabulary acquisition in primary schools.

The conceptual framework for this study situates AI-based learning as a catalyst for fostering learner engagement, which subsequently strengthens vocabulary retention. AI-powered tools provide multimodal input (e.g., visuals, sounds, and interactive tasks), gamification elements, and real-time feedback that actively stimulate students' interest. Heightened engagement encourages deeper cognitive processing, sustained motivation, and frequent opportunities to practice vocabulary in meaningful contexts. This active involvement serves as a mediating factor between technology use and the consolidation of new words into long-term memory. In line with Dual Coding Theory and the principles of Multimedia Learning, multimodal AI applications enhance memory processing pathways for young learners (Baddeley, 1990; Gordon & Lowry, 2024). Accordingly, this framework underscores that the effectiveness of AI does not reside solely in content delivery but in its ability to generate interactive, adaptive, and enjoyable experiences that promote both engagement and retention. By applying this perspective, the present study provides a novel contribution to the literature by examining how

Indonesian primary school teachers perceive the interconnection between AI- based learning, engagement, and vocabulary retention.

METHODS

This study aims to explore teachers' views on students' vocabulary retention after the application of AI-based technology, so the researcher uses a qualitative descriptive design. This method encourages researchers to describe phenomena in learning concretely. Descriptive design is appropriate for explaining various views and experiences of diverse participants. Accordingly, the findings of this study are expected to provide a comprehensive depiction of classroom realities.

Differences in teaching practices in various primary schools can be clearly exposed with a qualitative descriptive framework. This provides space for teachers' narratives. Data is focused on what and how experiences occur, not on why, the principle of cause and effect is tentative. This principle aligns with the objectives of the study, which investigates how far AI affects vocabulary retention. Enhancing contextual authenticity contributes to a deeper understanding of how AI-based technology is applied in the classroom.

This study is based on an interpretation model that views social facts as being formed by the relationships and structures of participant understanding. Researchers maintain a reflective distance in interpreting data so that the findings represent the teacher's opinion. The data obtained are not used for statistical generalization, but for transferability in the same context. This method is in accordance with the characteristics of qualitative descriptive research (Sandelowski, 2000).

The research procedure began with ethical approval from the program in which the researcher was not in. Participants were selected using purposive sampling aimed at primary English teachers who had used AI-based technology. Notifications and invitations were made using a special email and a teacher working group. A consent form was provided to each teacher, which encompassed provisions for confidentiality and the participants' right to withdraw from supervision at any stage.

The researcher used a Google Form link to ask for opinions through an open-ended questionnaire. This data collection process lasted for one week, allowing teachers sufficient time to provide their experiences with the questionnaire questions. Each teacher's responses were taken anonymously. The selection of Google Forms media was used because it can be easily accessed and is free in the data collection mechanism.

The researcher downloaded the data in spreadsheet form at the end of the data collection, then saved an encrypted copy on the researcher's device. Data validation was carried out by checking the completeness of the answers and removing information that identified individuals or schools. All steps taken adhere to guidelines related to problem procedures for qualitative research that focus on transparency (Creswell & Poth, 2018).

The data collection tool consisted of an open-ended questionnaire with five questions aimed at obtaining information about the experiences, effects, and barriers of using AI in vocabulary teaching. The questions were developed based on literature on student engagement and vocabulary retention and were reviewed by two language teaching experts to test the appropriateness and purpose of the questions. Before being distributed, the questionnaire was piloted by one primary school teacher to test the flow and time of filling it in. The results of the pilot questionnaire were not included in the analysis, but were useful for improving the existing instrument.

Data processing was carried out using thematic analysis. The process included automatic transcription from Google Forms to analysis document, repeated reading for familiarization, initial coding, grouping codes into themes, and reviewing themes for coherence with the data. To

track the frequency of codes and reflective memo notes, the researcher used spreadsheet software. This analytical approach made it easier for the researcher to find patterns of meaning associated with vocabulary retention and student engagement.

To increase credibility, the researcher conducted a peer debriefing with fellow graduate students and informal member checking by summarizing the findings that were sent back to two participants. Dependability was maintained with an audit trail in the form of decision analysis notes at each stage. Transferability is strengthened through descriptions of the school context and the profiles of the respondents. These steps are in line with the rigorous thematic analysis practices outlined by Braun & Clarke (2006).

Although this study employed a purposive sampling strategy involving seven primary school English teachers, the relatively small sample size inevitably limits the breadth of generalizability. The use of purposive sampling was justified by the need to engage participants with direct experience in integrating AI-based learning into vocabulary instruction, ensuring that the data collected was relevant and context-specific. To strengthen the trustworthiness of the findings, several validation procedures were conducted, including peer debriefing with fellow graduate researchers, informal member checking by sharing preliminary summaries with two participants, and maintaining an audit trail of analytic decisions throughout the study. Ethical considerations were carefully observed; this study obtained ethical clearance and informed consent from all participants, with assurances of confidentiality and the right to withdraw at any stage. Nonetheless, reliance solely on open-ended questionnaires via Google Forms constitutes a methodological limitation, as it restricts opportunities for deeper exploration of teachers' nuanced perspectives. Future studies are recommended to adopt methodological triangulation—such as incorporating semi-structured interviews or classroom observations—to enrich data sources and enhance the credibility and transferability of findings.

RESULTS

Findings from the thematic analysis reveal that employing AI-driven technology in teaching English vocabulary benefits primary school teachers. There are three themes from the data obtained, including: (1) The positive impact of AI-based technology on vocabulary retention and student participation, (2) Obstacles faced in implementing AI in elementary schools, and (3) Opportunities to expand the application of AI-based technology in primary school.

Impacts of AI on Vocabulary and Engagement

The first theme is regarding how AI can enhance students' memorization of words and get them more involved in class. The instructors described how the use of AI software, such as Duolingo and educational chatbots, assists in students' word memorization better and faster. This is also supported by the visual display and animations that capture the attention of the students, as well as the capacity of the application to display information in various formats. For one teacher, "Students find it easier to remember new words because the app displays images and sounds." Moreover, student participation greatly increased because learning was more fun and interactive. Teachers noted students getting more involved and even asking for more homework. One teacher concluded, "They often ask for additional training because they feel motivated." Features of games, such as quizzes and virtual rewards, are also believed to be behind the increased motivation of students towards learning from themselves. For example, one teacher highlighted, "Students find it easier to remember new words because the app displays images and sounds, making them more attentive."

In support of students' learning to be better, teachers also observe that AI technology has the benefit of a more customized and flexible learning process. Some teachers argued that AI applications can automatically modify the difficulty level of the questions according to each student's ability, whether it be shorter or longer questions, and even provide real-time feedback on their answers. One teacher said, "AI is very helpful because it can adjust the learning method

and track each student's progress automatically." Such a tailored approach makes learning English vocabulary more effective because students no longer feel fatigued by unengaging materials.

Teachers also understand that the AI technology offers students a tailored and adaptive learning environment in order to engage in English learning. AI-powered software can vary the teaching materials to suit the level of understanding of every student, either in terms of the complexity of the material or their learning pace. Many teachers argue that this kind of feature makes students feel more relaxed and not left behind by their peers. One teacher commented, "AI can automatically adjust the child's learning style and progress, so they don't feel stressed while learning." The instant feedback provided is also considered a very useful added value in the learning process, because students can immediately see their mistakes and correct them. This proves that AI supports varied and adaptive learning to the needs of each student.

The second theme highlighted various obstacles in adopting AI technology at the primary school level, especially related to infrastructure and the readiness of teachers. Several teachers indicated that the limited access to technological tools such as laptops and tablets was a constraint, coupled with unequal internet access, which are major obstacles to maximizing the potential of this technology. One teacher said, "Often the internet connection is unstable, so sometimes the application cannot be used when teaching." In addition, teachers also emphasized the importance of training and support for using AI technology effectively. They argued that incorporating AI into the curriculum is still difficult, especially since many teachers are not yet proficient in technology. Another participant emphasized motivation, noting, "They often ask for additional practice because they feel motivated by the games and rewards." These verbatim excerpts illustrate how AI applications foster both cognitive reinforcement and affective engagement, supporting the theme of enhanced vocabulary retention and classroom participation.

The third theme quoted the perceptions and optimism of the teachers regarding how AI may develop in schools. The teachers involved in the study reported that they were optimistic about the potential of AI to be implemented in primary schools. They believe that the technology holds huge potential to track students' progress, change the degree of difficulty in the curriculum, and provide immediate feedback. AI can automatically make changes to the learning method and monitor every child's progress, which is extremely helpful," another teacher added. Another teacher highlighted the need to balance technology use with students' need for social exposure and emotional development at a young age.

Whereas AI-based technology is believed to bring many positive impacts, there was a teacher worried about the social and emotional impact of embracing AI. According to her perception, excessive communication between students and AI devices could reduce the quality of students' relationships with each other, as well as students and teachers. The instructor continued, "I worry that if kids rely too much on AI, they will be deprived of socialization and empathy." This finding is a call to maintain the equilibrium in social engagement and the use of technology, especially among elementary students who are still at their emotionally vulnerable stage of development.

Overall, the research reveals that primary school teachers perceive AI-based technology as an augmenting tool in the classroom for enriching students' vocabulary and activating classroom participation. They also emphasize the need for apt infrastructure and specific teacher training, so that AI in English education and learning processes may be effective and sustainable.

DISCUSSION

The findings of this study demonstrate that integrating Artificial Intelligence (AI)-based technology into English vocabulary learning at the primary school level significantly enhances vocabulary retention and fosters active student engagement. Consistent with earlier studies, this result underscores the importance of technology in improving language learning by fostering

more individualized and stimulating learning experiences (Hwang & Fu, 2020; Wang & Vasquez, 2021).

The findings of this study align with Zou et al. (2022), who emphasized that AI-enhanced platforms significantly increase student engagement compared to traditional vocabulary teaching. Similarly, Rad and Alipour (2025) demonstrated that gamified digital tasks not only support short-term learning but also strengthen long-term vocabulary retention. The present study extends these findings by focusing on primary school learners, a group often overlooked in previous research. Practical implications emerge from these insights: teachers may integrate simple gamified applications, such as quiz-based platforms or AI-driven flashcards, to maintain learners' motivation and promote repeated exposure to new words. However, as one teacher cautioned about the risk of overreliance on AI, a balanced pedagogical approach is essential—one that combines technology with opportunities for peer interaction and collaborative activities. The increase in students' memory for new vocabulary in this study aligns with Nation's (2001) view. He argues that repetition, connecting with meaning, and active use are important elements for storing vocabulary in long-term memory. AI-based devices such as Duolingo, chatbots, and interactive quizzes have proven to be effective in presenting material multimodally through audio, text, and visuals. This indirectly strengthens students' memory processing pathways (Baddeley, 1990). This finding also emphasizes how crucial the theory of Dual Coding and Multimedia Learning is in the world of education for children in primary schools.

The enthusiasm and initiative of students in taking additional exercises independently reflect how important self-motivation is in learning. Ushioda (2011) also stated that the emotions involved and the feeling of belonging to learning activities can improve language skills, especially in remembering new words. Therefore, the gamification element and instant feedback from AI technology are very important in creating a learning environment that triggers students' emotions and thoughts. AI-based technology can also make the learning process more personal automatically.

This means that the level of difficulty of the material can be adjusted according to the ability of each child. This is following research conducted by Xie et al. (2019) on how AI technology can be adapted in learning. With a more personal method, students become more confident and do not feel left behind by their friends. Quick comments or input also help them to improve themselves. So, AI technology helps create different ways of learning and can answer the needs of each student.

Conversely, this does not mean that the application of technology is flawless. One of the main obstacles comes from inadequate infrastructure, such as the availability of devices and equal access to the internet. This is in line with the UNESCO study (2024), which highlighted the existence of a digital divide in basic education. In addition, teachers also need to develop competencies in integrating technology into the curriculum through periodic techno pedagogy training. Otherwise, technology will only be used as a simple feature, without exploring broader educational potential.

In general, this study clearly shows that AI has great potential to increase vocabulary and the involvement of primary school students in learning English. However, to optimize the use of this technology, adequate infrastructure, improved teacher training, and regulations that encourage the sustainability and inclusiveness of technology use in basic education are needed.

CONCLUSION

This research reveals that the application of AI-based technology in English learning in primary schools has a positive effect on improving students' memory and motivation. Interactive features such as visuals, games, personalization, and instant feedback have been shown to create an exciting and adaptive learning experience. Teachers saw that students memorized new words faster and were more motivated to learn, both in and outside the classroom. Furthermore, AI-

based technology facilitates a more flexible learning process that is tailored to students' individual needs, which in turn fosters self-confidence and learning independence. The results of this research are important for teachers and educational technology developers to carefully select and design AI platforms that match the characteristics of primary school students. Supporting policies such as improving digital infrastructure and training in learning technology are needed so that AI integration runs evenly and optimally.

A limitation of this study concerns the small number of participants, consisting of seven teachers from several primary schools within a single sub-district. Therefore, the results of this research cannot immediately draw general conclusions, but rather to understand how AI-based technology is used in teaching subjects under certain conditions. In the future, research should involve more teachers from various regions and types of schools. Also, other methods such as interviews or classroom observations can be added for a more complete understanding. Future studies may investigate the long-term influence of AI-based technology on learners' emotional and social development, in addition to its effectiveness in facilitating the acquisition of other language skills.

In practical terms, teachers are encouraged to adopt AI-based applications in a guided and selective manner, ensuring that technological features are integrated with interactive classroom practices. For policymakers, this study underscores the importance of investing in digital infrastructure and providing ongoing professional development programs that equip teachers with the skills necessary to effectively integrate AI tools into instruction. For future researchers, broader studies involving larger and more diverse samples, mixed-methods designs, and longitudinal investigations are recommended to capture the sustained impact of AI on both vocabulary retention and students' emotional development. By addressing these areas, future work can build a more comprehensive understanding of how AI-based learning can transform language education at the primary level.

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