

THE EFFECT OF ASSEMBLR EDU ON THE FOURTH-GRADE STUDENTS' VOCABULARY AT SDN LIRBOYO 2

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Abstract

English vocabulary mastery is fundamental to developing language proficiency; however, many elementary school students still experience difficulties in learning and retaining English vocabulary due to the limited use of interactive instructional media. This study aimed to investigate the effect of Assemblr Edu on the English vocabulary mastery of fourth-grade students at SDN Lirboyo 2 during the 2024/2025 academic year. A pre-experimental research design employing a one-group pretest-posttest approach was adopted. The participants consisted of 28 fourth-grade students selected through total sampling. Data were collected using vocabulary tests administered before and after the implementation of Assemblr Edu, which integrated the AR Viewer and Instant Presentation features to teach vocabulary related to Things in the Living Room and Bedroom. The data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, and the Wilcoxon Signed-Rank Test. The findings revealed that students' mean score increased from 75.36 on the pre-test to 90.36 on the post-test. The Wilcoxon Signed-Rank Test indicated a statistically significant improvement in students' vocabulary mastery ($Z = -4.406$, $p < .001$), with 25 students showing improved scores, three students maintaining the same scores, and none experiencing a decrease. These findings demonstrate that Assemblr Edu is an effective technology-enhanced learning medium for improving English vocabulary mastery among elementary school students by providing interactive, visual, and contextual learning experiences. The study suggests that integrating Augmented Reality into English vocabulary instruction can support more engaging and meaningful learning for young EFL learners.

Keywords: *Assemblr Edu, Augmented Reality, English Vocabulary, Elementary School, Vocabulary Mastery*

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INTRODUCTION

English plays an essential role as an international language in various aspects of global life, including education, technology, business, and communication. Consequently, English proficiency has become an increasingly important competency for young learners in Indonesia. Ministry of Education (2022) emphasizes the importance of English in preparing students to face global challenges, while UNESCO (2021) identifies foreign language proficiency as one of the key competencies required for twenty-first century learners. Among the four language skills, vocabulary serves as the foundation of language learning because learners cannot effectively develop listening, speaking, reading, and writing skills without adequate vocabulary knowledge (Nation, 2022). Therefore, vocabulary mastery is considered one of the primary objectives of English instruction at the elementary school level.

Despite its importance, English vocabulary learning in Indonesian elementary schools continues to face various challenges. One of the major problems is the limited use of effective

instructional strategies and learning media. English instruction is still frequently dominated by teacher-centered approaches, such as lectures, textbook-based learning, and memorization activities, which provide limited opportunities for students to actively participate in the learning process (Pertiwi et al., 2021). In contrast, student-centered learning encourages learners to become more actively involved through interaction, collaboration, and meaningful learning experiences (Shafi & Masood, 2023). Considering that elementary school students generally have short attention spans and learn more effectively through concrete, visual, and interactive experiences (Cameron, 2001), conventional instructional methods often fail to maintain students' interest and motivation during vocabulary learning.

Vocabulary learning difficulties are also reflected in students' inability to remember new words, understand word meanings, pronounce vocabulary correctly, and apply newly acquired vocabulary in classroom communication (Ryan et al., 2024). Furthermore, English learning materials used in many elementary classrooms often provide limited visual representation and insufficient contextual learning experiences, making vocabulary acquisition less meaningful for young learners (Tomlinson, 2013; Mayer, 2014). The implementation of digital learning in primary education is also constrained by inadequate technological infrastructure, unstable internet connectivity, and limited access to digital devices (Ravendaran & Nasri, 2025). These conditions collectively contribute to students' low vocabulary achievement and reduce the effectiveness of English language instruction.

The preliminary observation conducted at SDN Lirboyo 2 revealed similar problems among fourth-grade students. Many students experienced difficulties in remembering English vocabulary, distinguishing the meanings of similar words, and pronouncing unfamiliar vocabulary accurately. Classroom learning was still dominated by teacher explanations, textbooks, and printed pictures, while students had limited opportunities to interact with engaging learning media. As a result, student participation remained relatively low, and many students obtained vocabulary scores below the school's minimum mastery criterion. These findings indicate the need for more innovative instructional media that can create meaningful and engaging vocabulary learning experiences for elementary school students.

The rapid development of educational technology provides opportunities to improve the quality of English language learning through interactive digital media. Multimedia learning theory suggests that combining visual and verbal information can significantly improve students' understanding and retention of learning materials (Mayer, 2014). One technology that has received increasing attention in language education is Augmented Reality (AR), which integrates virtual three-dimensional objects into real-world environments to create interactive learning experiences. AR enables learners to visualize abstract concepts more concretely, thereby increasing motivation, engagement, and learning achievement (Lai & Chang, 2021).

Among various AR-based learning platforms, Assemblr Edu offers several educational features that support interactive classroom instruction. In particular, the AR Viewer feature enables students to observe three-dimensional learning objects directly through mobile devices, while the Instant Presentation feature allows teachers to deliver interactive learning materials in presentation format. These features are expected to facilitate vocabulary learning by presenting vocabulary

items through realistic visualizations that encourage active student participation and meaningful learning experiences.

Previous studies have consistently reported the positive contribution of Augmented Reality to English language learning. Umar et al. (2025) found that Assemblr Edu significantly improved elementary school students' vocabulary mastery and vocabulary retention. Similarly, Carrión-Robles et al. (2023) reported that the implementation of Assemblr Edu enhanced students' English language skills while increasing learning motivation and classroom engagement. Other studies also demonstrated that AR-based learning positively influences students' vocabulary acquisition, creativity, learning motivation, and participation in English classrooms (Rosyidah et al., 2023; Arjulayana & Pujiati, 2025). More recent studies further confirmed that AR applications provide interactive and contextual learning experiences that improve vocabulary comprehension and retention among young learners (Rahmadani et al., 2024; Rizkina et al., 2025; Sagita et al., 2025; Mursyida et al., 2023). Nevertheless, several researchers also highlighted challenges related to device availability, internet accessibility, and users' technological readiness during AR implementation (Majid et al., 2023; Khoerunnisa, 2025).

Although previous studies have demonstrated the effectiveness of Augmented Reality in English language learning, several research gaps remain. First, most studies have investigated AR applications in general rather than focusing specifically on the pedagogical features provided by Assemblr Edu. Second, previous research has primarily involved secondary schools and higher education, while empirical studies involving elementary school students remain relatively limited. Third, existing studies have generally emphasized students' motivation and engagement, whereas evidence concerning vocabulary mastery improvement through Assemblr Edu in elementary school contexts is still insufficient. Furthermore, no previous study has specifically examined the implementation of Assemblr Edu among fourth-grade students at SDN Lirboyo 2.

Therefore, this study investigates the effect of Assemblr Edu on fourth-grade students' English vocabulary mastery at SDN Lirboyo 2. The study specifically integrates the AR Viewer and Instant Presentation features of Assemblr Edu to teach the topic Things in the Living Room and Bedroom. By examining the implementation of these instructional features in an Indonesian elementary school context, this study provides empirical evidence regarding the effectiveness of technology-enhanced vocabulary instruction and contributes practical insights into the integration of Augmented Reality as an innovative learning medium for young English language learners.

METHOD

This study employed a pre-experimental research design using a one-group pretest-posttest design to investigate the effect of Assemblr Edu on fourth-grade students' English vocabulary mastery. In this design, students completed a pre-test before the instructional treatment and a post-test after the intervention. The difference between the two test scores was used to determine the effectiveness of the learning media. The study was conducted at SDN Lirboyo 2, Kediri, Indonesia, during the 2024/2025 academic year. The participants consisted of 28 fourth-grade students. Since all students in the class participated in the study, total sampling was employed. This technique allowed the researcher to evaluate the effectiveness of the intervention using the entire population of the study.

The instructional treatment employed Assemblr Edu, an Augmented Reality (AR)-based educational platform integrating the AR Viewer and Instant Presentation features. The learning materials focused on the topic Things in the Living Room and Bedroom, covering vocabulary related to common household objects such as table, chair, sofa, lamp, bed, pillow, and cupboard. The AR Viewer feature enabled students to observe three-dimensional representations of vocabulary items, while the Instant Presentation feature facilitated interactive vocabulary instruction, pronunciation practice, classroom discussions, and guided learning activities. Throughout the lessons, students were encouraged to identify vocabulary meanings, practice pronunciation, and construct simple sentences using the target words. The implementation of the learning activities and the use of Assemblr Edu are presented in Figures 1–3.

The intervention was conducted over three classroom meetings. During the first meeting, students completed the pre-test before receiving the initial instructional treatment using Assemblr Edu. The second meeting focused on vocabulary learning activities utilizing the AR Viewer and Instant Presentation features. During the third meeting, students participated in reinforcement activities and completed the post-test to measure their vocabulary mastery after the intervention. Data were collected using a researcher-developed vocabulary test, which served as both the pre-test and post-test. The instrument consisted of 20 objective items representing four task types: word completion, picture matching, fill-in-the-blank, and jumbled sentence arrangement. These tasks were designed to assess students' ability to recognize, understand, and use English vocabulary related to Things in the Living Room and Bedroom. Although the pre-test and post-test shared the same blueprint and learning indicators, different test items were administered in the post-test to reduce the possibility of practice effects while maintaining an equivalent level of difficulty.

Table 1. Blueprint of the Vocabulary Test

Section	Indicator	Number of Items
Word Completion	Completing missing letters to form correct vocabulary	5
Picture Matching	Matching pictures with appropriate vocabulary	5
Fill in the Blank	Completing simple sentences using suitable vocabulary	5
Jumbled Sentence Arrangement	Rearranging words into meaningful sentences	5
Total		20

The collected data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were first employed to summarize students' vocabulary achievement by calculating the

minimum score, maximum score, mean, and standard deviation for both the pre-test and post-test. The normality of the data distribution was examined using the Shapiro–Wilk test. Since both datasets were not normally distributed ($p < .05$), hypothesis testing was conducted using the Wilcoxon Signed-Rank Test, which is appropriate for paired samples that do not satisfy the assumption of normality. Statistical significance was determined at the 0.05 significance level.

Prior to conducting the study, permission to carry out the research was obtained from the principal of SDN Lirboyo 2 and the classroom teacher. The study was conducted as part of regular classroom instruction, and all data were collected solely for research purposes while maintaining the confidentiality of the participants.

RESULT AND DISCUSSION

Result

This study investigated the effect of Assemblr Edu on the English vocabulary mastery of fourth-grade students at SDN Lirboyo 2. Students' vocabulary achievement before and after the



intervention was analyzed using descriptive statistics and the Wilcoxon Signed-Rank Test. Before presenting the statistical findings, Figures 1–3 illustrate the learning activities conducted using Assemblr Edu. The instructional process integrated two main features of the application, namely Instant Presentation for delivering vocabulary materials and AR Viewer for displaying three-dimensional objects related to *Things in the Living Room and Bedroom*. Through these features, students observed virtual objects, practiced pronunciation, identified word meanings, and applied the target vocabulary in guided classroom activities.

Figure 1. The Implementation of Assemblr Edu in English Vocabulary Instruvton

Figure 1 shows the classroom implementation of Assemblr Edu during English vocabulary instruction. The teacher introduced vocabulary through interactive presentations while students actively observed, responded to questions, and participated in classroom activities. The learning

process encouraged students to engage with the instructional materials and interact more actively than during conventional learning.



Figure 2. Instant Presentation Feature in Assemblr Edu

Figure 2 presents an example of the Instant Presentation feature used during instruction. The feature displays vocabulary items together with visual illustrations of objects found in the bedroom, enabling students to learn word meanings, pronunciation, and object identification in a contextual manner.

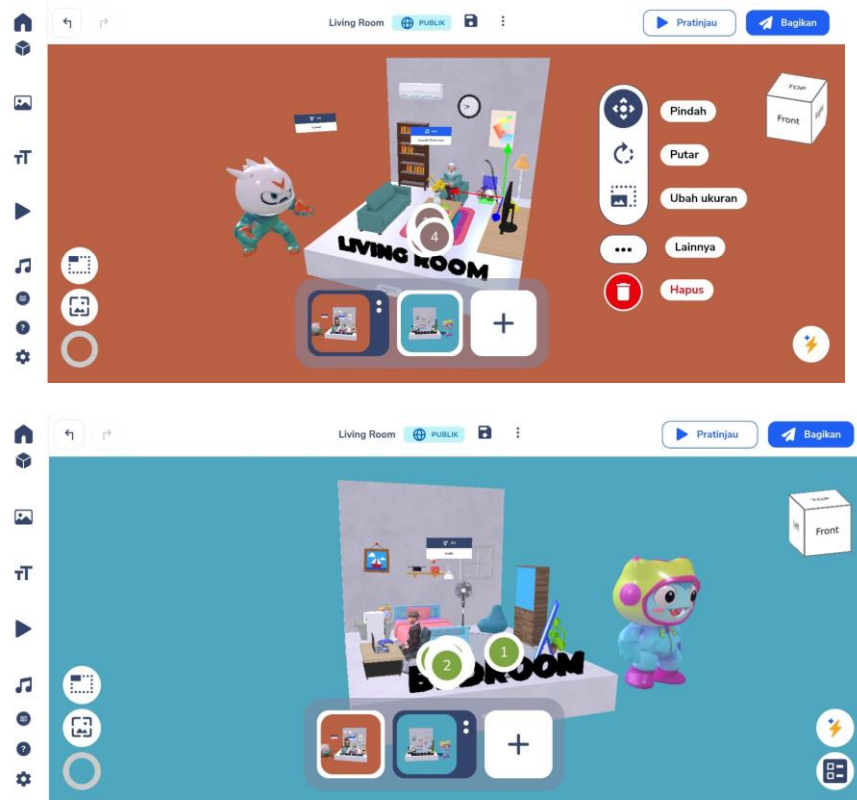


Figure 3. AR Viewer Display of Three-Dimensional Vocabulary Objects

Figure 3 illustrates the AR Viewer feature of Assemblr Edu, which allows students to explore three-dimensional models of household objects. Through this feature, students could observe vocabulary items from different perspectives and associate English words with realistic visual representations, creating a more concrete and engaging learning experience.

Following the learning activities, students completed the post-test to evaluate the effectiveness of the intervention. The descriptive statistics of the students' pre-test and post-test scores are presented in **Table 2**.

Table 2. Descriptive Statistics of Students' Vocabulary Scores

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	28	60	100	75.36	9.121
Posttest	28	80	100	90.36	5.762
Valid N (listwise)	28				

Table 1 shows that students' vocabulary mastery improved after learning through Assemblr Edu. The mean score increased from 75.36 in the pre-test to 90.36 in the post-test, indicating an average improvement of 15 points. The minimum score also increased from 60 to 80, while the maximum score remained 100. In addition, the standard deviation decreased from 9.121 to 5.762, indicating that students' achievement became more consistent after the intervention. These findings suggest that the implementation of Assemblr Edu not only improved students' overall vocabulary performance but also reduced the variation in students' achievement.

To provide a clearer overview of students' achievement, the comparison of individual pre-test and post-test scores is presented in Figure 4.

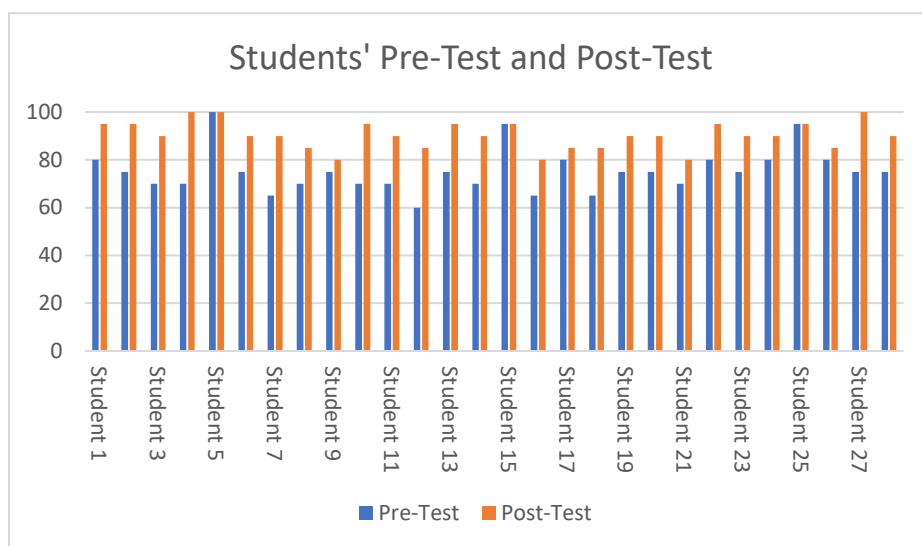


Figure 4. Comparison of Students' Pre-test and Post-test Scores

Figure 4 demonstrates that the majority of students obtained higher scores in the post-test than in the pre-test. Almost all students showed improvements in vocabulary mastery after participating in learning activities using Assemblr Edu, while no students experienced a decline in their achievement.

Before testing the research hypothesis, the normality of the data distribution was examined using the Shapiro-Wilk test. The results are presented in Table 3.

Table 3. Results of the Shapiro-Wilk Normality Test

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.230	28	.001	.870	28	.002
Posttest	.190	28	.011	.921	28	.036

a. Lilliefors Significance Correction

As shown in Table 3, the significance values for both the pre-test (0.002) and the post-test (0.036) were lower than the significance level of 0.05. Therefore, the data were not normally distributed,

indicating that a non-parametric statistical test was required. Consequently, the Wilcoxon Signed-Rank Test was employed to examine whether there was a significant difference between students' pre-test and post-test scores.

The distribution of score changes is presented in Table 4.

Table 4. Wilcoxon Signed-Ranks Results

Ranks		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0 ^a	.00	.00
	Positive Ranks	25 ^b	13.00	325.00
	Ties	3 ^c		
	Total	28		

a. Posttest < Pretest

b. Posttest > Pretest

c. Posttest = Pretest

Table 4 indicates that 25 students obtained higher scores in the post-test than in the pre-test, while three students obtained identical scores in both tests. No students experienced a decrease in their vocabulary scores following the learning intervention. These findings indicate that the improvement in students' vocabulary mastery occurred consistently across almost all participants.

The statistical significance of the improvement is presented in Table 5.

Table 5. Wilcoxon Signed-Ranks Test Statistics

Test Statistics ^a	
	Posttest - Pretest
Z	-4.406 ^b
Asymp. Sig. (2-tailed)	.000

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

As presented in Table 4, the Wilcoxon Signed-Rank Test produced a Z value of -4.406 with an Asymp. Sig. (2-tailed) value of .000, which is lower than the significance level of 0.05. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted. These findings indicate that the implementation of Assemblr Edu had a statistically significant positive effect on the English vocabulary mastery of fourth-grade students at SDN Lirboyo 2.

Discussion

The findings of this study demonstrate that the implementation of Assemblr Edu significantly improved the English vocabulary mastery of fourth-grade students at SDN Lirboyo 2. This improvement is reflected in the increase in the mean score from 75.36 in the pre-test to 90.36 in the post-test. Moreover, the Wilcoxon Signed-Rank Test confirmed that the improvement

was statistically significant ($Z = -4.406$, $p < .001$). The absence of negative ranks and the presence of positive ranks for 25 students further indicate that the learning intervention consistently contributed to students' vocabulary achievement.

One possible explanation for these findings is that Assemblr Edu provides an interactive learning environment through the integration of Augmented Reality (AR). The AR Viewer feature enables students to observe three-dimensional representations of household objects, while the Instant Presentation feature supports vocabulary explanation, pronunciation practice, and classroom interaction. These visual and contextual learning experiences help students connect English vocabulary with real-life objects, making abstract vocabulary more concrete and easier to understand.

The findings are consistent with Nation (2022), who argues that vocabulary mastery involves not only recognizing words but also understanding their meanings and using them appropriately in context. During the learning activities, students learned vocabulary by observing three-dimensional objects, identifying their meanings, practicing pronunciation, and using the target words in simple sentences. These activities supported multiple aspects of vocabulary acquisition and promoted deeper understanding of the target vocabulary.

The improvement in students' vocabulary mastery can also be explained through Mayer (2014) Cognitive Theory of Multimedia Learning and Paivio (1991) Dual Coding Theory. According to these theories, learning becomes more effective when information is presented through both verbal and visual channels. In this study, students received vocabulary input through teacher explanations, written text, images, and three-dimensional AR objects simultaneously. The combination of verbal and visual representations likely enhanced students' cognitive processing and facilitated vocabulary retention.

From the perspective of teaching young learners, the findings support the views of Cameron (2001), Scott & Ytreberg (2004), and Pinter (2017), who emphasize that elementary school students learn more effectively through visual, interactive, and meaningful learning experiences. Classroom observations during the implementation of Assemblr Edu indicated that students were more enthusiastic, actively participated in classroom discussions, and showed greater confidence in answering vocabulary-related questions. Compared with conventional textbook-based instruction, the use of AR created a more engaging learning environment that maintained students' attention throughout the lessons.

The findings are also supported by Piaget (1973) Constructivist Theory and Vygotsky (1978) Social Constructivism, which emphasize that knowledge is actively constructed through interaction and learning experiences. Rather than memorizing isolated vocabulary items, students explored learning materials through observation, discussion, and guided practice. This active learning process encouraged students to construct their own understanding of English vocabulary, leading to better learning outcomes.

The present findings are consistent with previous studies investigating the effectiveness of Augmented Reality in English language learning. Umar et al. (2025) reported that Assemblr Edu significantly improved elementary school students' vocabulary mastery and vocabulary retention.

Similarly, Carrión-Robles et al. (2023) found that AR-based learning enhanced students' English language skills while increasing motivation and classroom engagement. Studies conducted by Arjulayana & Pujiati (2025) and Rosyidah et al. (2023) also demonstrated that Assemblr Edu positively influenced students' vocabulary mastery and learning motivation. Furthermore, Sagita et al. (2025) and Mursyida et al. (2023) concluded that AR-based learning provides interactive and multimodal learning experiences that enhance students' understanding and engagement during English instruction.

Unlike many previous studies that focused on general AR applications or involved secondary and higher education students, this study specifically examined the implementation of the AR Viewer and Instant Presentation features of Assemblr Edu in vocabulary instruction for elementary school students. Therefore, the study contributes empirical evidence regarding the effectiveness of these features in supporting vocabulary acquisition among young EFL learners in the Indonesian elementary school context.

The findings also provide practical implications for English language teaching. The successful implementation of Assemblr Edu indicates that integrating Augmented Reality into vocabulary instruction can create more engaging, student-centered, and contextual learning experiences. English teachers may consider incorporating technology-enhanced learning media to improve vocabulary instruction and increase students' motivation and classroom participation. Schools may also support the adoption of digital learning technologies to enhance the quality of English language education at the elementary level.

Despite these encouraging findings, several limitations should be acknowledged. This study employed a one-group pretest-posttest design without a control group, making it difficult to attribute all observed improvements solely to the intervention. In addition, the study involved only 28 students from a single elementary school and focused exclusively on vocabulary related to Things in the Living Room and Bedroom. Future research is therefore recommended to involve larger samples, include control groups, investigate other English language skills, and examine the long-term effects of Assemblr Edu on vocabulary retention.

Overall, the findings indicate that Assemblr Edu is an effective technology-enhanced learning medium for improving English vocabulary mastery among elementary school students. The integration of Augmented Reality into English language instruction provides meaningful, interactive, and contextual learning experiences that support vocabulary acquisition and encourage active student participation

CONCLUSION AND SUGGESTION

The findings of this study demonstrate that the implementation of Assemblr Edu significantly improved the English vocabulary mastery of fourth-grade students at SDN Lirboyo 2. Students' mean score increased from 75.36 in the pre-test to 90.36 in the post-test, and the Wilcoxon Signed-Rank Test confirmed that the improvement was statistically significant ($Z = -4.406$, $p < .001$). The integration of the AR Viewer and Instant Presentation features provided interactive, visual, and contextual learning experiences that helped students understand, retain, and use English vocabulary more effectively. These findings indicate that Assemblr Edu can serve

as an effective technology-enhanced learning medium for supporting vocabulary instruction among young EFL learners in elementary schools.

This study also contributes to the growing body of research on technology-enhanced language learning by providing empirical evidence of the effectiveness of the AR Viewer and Instant Presentation features of Assemblr Edu in improving English vocabulary mastery among Indonesian elementary school students. Unlike previous studies that mainly investigated Augmented Reality applications in general or focused on secondary and higher education contexts, this research specifically demonstrates the educational potential of these two Assemblr Edu features for vocabulary instruction in elementary schools. Therefore, the findings enrich the existing literature on Augmented Reality-assisted language learning and provide practical insights for integrating innovative digital media into English instruction for young learners.

Based on these findings, English teachers are encouraged to integrate Augmented Reality-based learning media such as Assemblr Edu into vocabulary instruction to create more engaging, interactive, and student-centered learning experiences. Schools are also encouraged to support the implementation of technology-enhanced learning by providing adequate digital facilities and teacher training. Future researchers are recommended to conduct studies with larger and more diverse samples, employ experimental designs with control groups, extend the duration of the intervention, and investigate the effectiveness of Assemblr Edu in improving other English language skills, such as listening, speaking, reading, and writing, as well as students' long-term vocabulary retention.

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