

Augmented Reality to Improve English Comprehension and Retention in Third-Grade Students

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ABSTRACT

English proficiency at the elementary level in Indonesia remains relatively low, particularly in the Kalianda region of South Lampung, Sumatra. This issue has become a pressing concern ahead of the mandatory English policy for elementary schools starting in the 2027/2028 academic year. Indonesia's score in the 2024 EF English Proficiency Index, ranked 80th out of 116 countries, underscores the urgency of renewing teaching methods. Currently, conventional approaches such as lectures and rote memorization dominate, while technology-based methods, including Augmented Reality (AR), are scarcely implemented at the primary education level, especially in Kalianda. The primary objective of this study is to develop and implement AR-based learning media to enhance the comprehension and retention of English materials among third-grade elementary students in Kalianda, South Lampung. The study employs a Research and Development (RnD) approach using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The research subjects comprised 134 third-grade students from five elementary schools in Kalianda, selected through cluster sampling. The AR application is developed by considering the distribution of basic English materials and an age-appropriate user experience for elementary students. Findings indicate that AR enhances comprehension and retention by providing interactive, multi-sensory experiences that support differentiated learning. Low-performing students achieved substantial improvements, while higher-performing students advanced further. No declines in scores were observed, highlighting AR's effectiveness in creating an engaging, safe, and motivating learning environment that fosters meaningful, long-term learning outcomes.

Keywords: *Augmented Reality (AR); English Language Learning; Elementary School; Comprehension; Retention*

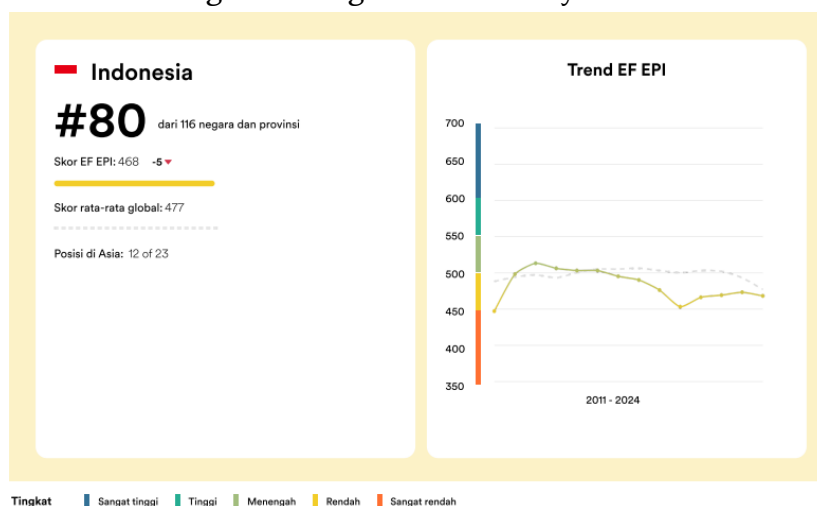
INTRODUCTION

English language learning in Indonesian elementary schools serves as a foundational stage for developing global communication skills from an early age. In many regions, including Kalianda, South Lampung, third-grade students demonstrate

limited comprehension and weak retention of basic English vocabulary and sentence structures. These challenges are closely linked to the persistent use of conventional instructional methods—primarily lectures and rote memorization—that provide minimal opportunities for interaction and contextual learning. The limited availability of engaging learning media and the shortage of qualified English teachers further exacerbate the problem (Rahma, Harjono, & Sulisty, 2023). In addition, the shortage of educators with strong competencies in teaching English remains a major obstacle to improving students' understanding and motivation (Hartati, 2022).

The urgency of strengthening English instruction in elementary schools increased following the enactment of Permendikbudristek No. 12 of 2024, which mandates English as a compulsory subject beginning in the 2027/2028 academic year. This regulatory change demands pedagogical innovations capable of improving not only basic cognitive abilities but also students' conceptual understanding and long-term retention.

Figure 1. English Proficiency Index



Source: EF English Proficiency Index, 2024

National indicators also reinforce the need for curriculum and method reform. According to the 2024 EF English Proficiency Index, Indonesia ranks 80th out of 116 countries, with a score of 468—below the global average and declining from the previous year. This position highlights systemic challenges in English language education and underscores the need for more effective, technology-enhanced instructional strategies.

In English language learning, comprehension refers to students' ability to understand, interpret, and functionally use linguistic information (Gurning, 2008). Meanwhile, retention is defined as the capacity of students to store and recall learned information (Usholiha & Wardianto, 2017). The use of technology is essential in improving both aspects of English learning. Augmented Reality (AR) emerges as a promising alternative, capable of delivering content visually and interactively through three-dimensional elements that integrate the real and digital worlds. Empirical studies have demonstrated that AR-based learning significantly enhances both comprehension and retention.

Previous research has found that AR in education provides deeper learning experiences and increases student engagement (Fauziyah, Sugiman, & Munahefi, 2024).

Other studies argue that AR supports experiential learning, thereby strengthening long-term memory and conceptual understanding (Putra, Kartini, & Abenk, 2024). Moreover, English learners using AR exhibited a 28% improvement in vocabulary retention compared to conventional methods (Tyson, 2021). On the other words, comprehension refers to the ability to understand and interpret linguistic information, while retention concerns the ability to store and recall learned material over time. Both dimensions remain problematic in Indonesian elementary contexts. Low motivation, insufficient exposure, and limited instructional media contribute to weak learning outcomes.

Technological innovations—particularly Augmented Reality (AR)—have gained attention as tools capable of enhancing comprehension and retention. AR provides interactive, multi-sensory, and context-rich learning experiences by merging digital content with the real environment. Research indicates that AR increases student engagement, improves conceptual understanding, and strengthens long-term memory. Several studies report improvements in vocabulary learning and enhanced motivation when AR is integrated into classroom activities.

However, despite its proven benefits, the application of AR at the elementary school level in Indonesia—especially in non-urban regions such as Kalianda—remains extremely limited. Existing literature primarily focuses on secondary or higher education settings, resulting in a lack of empirical evidence on AR effectiveness for young learners, insufficient attention to user experience design tailored to children, and minimal research connecting AR use with upcoming national policy mandates.

This gap indicates the need for a development and evaluation study that designs AR-based learning media specifically for elementary English instruction and assesses its impact on comprehension and retention.

From this discussion, it can be inferred that several factors contribute to the low interest in learning English among elementary school students. The lack of engaging learning materials also plays a role in diminishing student motivation (Kusuma & Apriyanto, 2018; Firmansyah, 2015). English language skills at an early age are essential for facing the challenges of globalization and digital advancement (Sirajuddin, 2018). Therefore, the adoption of innovative technologies such as AR in the learning process can be an effective solution to enhance comprehension and retention, thus better preparing students for educational policy changes and the demands of modern society (Gottschalk, 2019; Mustaqim, 2016).

In this context, the research adopts a Research and Development (R&D) approach. The proposed application will be designed with consideration of the distribution of basic English materials and a user experience suited for elementary students. Accordingly, this study aims to design and develop a mobile-based AR application that incorporates English learning content for third-grade elementary students.

The research problems addressed in this study are how is the development process of an AR-based learning medium that is suitable for improving comprehension and retention of English material among third-grade elementary students in Kalianda, South Lampung? Is the developed AR-based learning medium effective in enhancing students' comprehension and retention of English material? The main objectives of this research

are to develop and implement an AR-based learning medium to improve the comprehension and retention of English language material among third-grade elementary school students in Kalianda, South Lampung.

METHOD

This study employs a Research and Development (RnD) approach aimed at developing and testing the effectiveness of Augmented Reality (AR) in enhancing the understanding and retention of English learning materials among third-grade elementary school students in Kalianda, South Lampung. The RnD approach is utilized in this study because it focuses on the development of a product in the form of AR-based learning media and its effectiveness testing within an educational setting. The development model used in this study is the ADDIE model, which consists of five main stages: Analysis, Design, Development, Implementation, and Evaluation, ensuring that the resulting product provides tangible benefits for student learning.

The population of this study includes all third-grade elementary school students in the Kalianda District of South Lampung, totaling 45 schools. Assuming each class consists of 30 students, the total population amounts to 1,350 students. This population was selected based on the study's objective to examine the effectiveness of AR in improving students' understanding and retention at the elementary education level, particularly in English learning. The research sample was selected using a random sampling technique, resulting in 10% of the total population, which corresponds to 135 students from 5 schools.

The choice of Kalianda District as the research location is based on several considerations: it serves as the administrative center of South Lampung Regency, has a high density of elementary schools, and exhibits diverse school characteristics. Additionally, ease of access, availability of supporting data, and the relevance of educational issues in the area make Kalianda a representative and strategic location for this study.

Research Steps:

1. Initial Data Collection

The initial data collection was conducted to serve as a basis for drafting the research problem background. This activity was carried out in January by the Team Leader and two team members.

2. Analysis (Needs Analysis)

At this stage, a literature review, curriculum analysis, and interviews with teachers, education experts, and media specialists were conducted to identify the needs and challenges in teaching English at elementary schools. The data obtained served as the foundation for developing AR-based learning media. The needs analysis was conducted in February by the Team Leader and two team members.

3. Design (Product Design)

The product design was created based on observations made during the needs analysis stage. The product consists of an application that transforms learning materials into more tangible and engaging content through 3D (three-dimensional) visualization. The application was developed to align with the textbooks used by teachers and students according to the existing curriculum, enhancing both the visual and content aspects to make it more appealing and easier to understand. This product design activity was conducted from March to April by the Team Leader and two team members.

4. Development

This stage involves the production process, transforming the manuscript into a more interactive learning medium by implementing Augmented Reality (AR). Before classroom implementation, the AR-based learning media undergoes verification and validation. Validation is conducted by inviting experts with substantial experience in AR-based educational media and English teaching. The media expert is Ribut Julianto, S.Kom., M.Kom., a lecturer in computer theory and applications, and the content expert is Guntur Esa Mukti, S.Pd., a third-grade elementary school English teacher. The development activities were carried out by the entire research team from April to June, led by the Team Leader and two members.

5. Implementation

In this stage, the developed AR learning materials are pilot-tested before full classroom implementation. The purpose of this trial is to identify weaknesses and shortcomings in both the content and application. Once the testing is complete and the product is deemed feasible, it can then be applied in the learning process. This stage is scheduled for July to September, conducted by the Team Leader and two members.

6. Evaluation

Product evaluation aims to determine the effectiveness of the AR learning media. If any weaknesses or shortcomings are identified during the trial, revisions are necessary. Researchers evaluate the performance of the developed product to identify areas for improvement, providing recommendations to refine and perfect the final product. This activity is planned for September to October, conducted by the Team Leader and two members.

7. Final Report and Research Outputs

The final stage involves preparing the research report and submitting it within the designated timeframe. In addition, the mandatory research outputs include a scientific article to be published in a nationally accredited SINTA 4 journal, namely the Journal Corner of Education, Linguistics, and Literature, as well as policy recommendations for government and educational institutions. This activity is scheduled for November to December and will be carried out by the Team Leader and two members.

The target achievement indicators of this study include the development of AR learning media that aligns with the needs of English instruction in elementary schools, aiming to enhance students' understanding and retention of English learning materials. Additionally, the research outputs include intellectual property rights (IPR) and a video documenting the research activities, which will be uploaded to YouTube.

The overall implementation model described above can be illustrated in the following flowchart:

Figure 2. Research Flowchart



FINDINGS AND DISCUSSION

To comprehensively understand the impact of implementing Augmented Reality (AR) on students' learning outcomes, the findings from several elementary schools in Kalianda, South Lampung, were systematically analyzed. The evaluation focused on comparing students' Pre-Test and Post-Test results to measure improvements in both understanding and retention of English materials. The following section presents the findings and discussion, organized by each school, to highlight patterns of progress, variations in learning gains, and the overall effectiveness of AR-based learning interventions.

1. SDN Kecapi

The results of the study indicate an improvement in students' scores after participating in the learning process. Students' Pre-Test scores ranged from 40 to 70, with an average still considered low, whereas the Post-Test scores increased to a range of 60 to 80. This improvement is quite significant, as all students experienced score increases, albeit to varying degrees.

Most students who initially scored 40 on the Pre-Test improved to 70 on the Post-Test, while those who started with a score of 60 were able to reach 80. Even students who were initially in the medium score category advanced to the good category after the learning intervention. The average score gain ranged from 10 to 30 points, indicating

that the implemented learning process was effective in enhancing students' learning outcomes

2. SDN Sidomakmur

The learning outcome data of students at SD Negeri Sidomakmur indicate an improvement in scores after participating in the learning process. Students' Pre-Test scores ranged from 40 to 70, while their Post-Test scores increased to a range of 60 to 90, reflecting significant development in the abilities of most students.

The group of students with an initial score of 70 all improved to 90, indicating achievement in the "very good" category after the learning intervention. Students who initially scored 40 also improved to 70, moving from the "low" to the "good" category. Meanwhile, some students who initially scored 50 increased to 60 or 70, showing progress, although smaller compared to other groups.

The average score increase ranged from 10 to 30 points, with all students showing improvement and none experiencing a decline. This indicates that the applied learning method was effective in enhancing students' understanding, although the degree of improvement varied according to each student's initial ability.

3. SDN Way Lubuk

The measurement results indicate an improvement in students' scores following the implementation of the learning intervention. Students' Pre-Test scores ranged from 40 to 70, while Post-Test scores increased to a range of 60 to 90, demonstrating a consistent improvement in learning outcomes across nearly all students.

Most students who initially scored 60 improved to 80, indicating a significant increase from the "medium" to the "good" category. Similarly, students with a Pre-Test score of 70 were able to achieve 80 to 90 on the Post-Test, placing them in the "very good" category. Meanwhile, students who initially scored 40 increased to 70, showing development from the "low" to the "good" category.

The average score increase ranged from 10 to 30 points, with variations influenced by each student's initial ability. No students experienced a decline in scores, suggesting that the implemented learning intervention was effective in improving overall student learning outcomes.

4. SDN Gunung Terang

Based on the evaluation results, there was an improvement in the learning outcomes of students at SD Negeri Gunung Terang after participating in the learning intervention. Students' Pre-Test scores ranged from 50 to 70, while Post-Test scores increased to a range of 60 to 90, indicating that all students experienced an improvement in their learning outcomes.

Students who initially scored 50 mostly improved to 60–70, demonstrating progress from the "low" to the "medium" category. Meanwhile, students with an initial score of 60 achieved higher gains, reaching 70–80, with some even attaining 90. Students who initially scored 70 improved to 80–90, placing them in the "very good" category.

Overall, score improvements ranged from 10 to 20 points, with some students achieving higher gains. The fact that no students experienced a decline in scores confirms that the implemented learning approach was effective in enhancing students' understanding and mastery of the material.

5. SDN Agom

The evaluation results at SD Negeri Agom indicate a significant improvement in students' learning outcomes following the learning intervention. Students' Pre-Test scores ranged from 40 to 70, while Post-Test scores increased to a range of 70 to 90, demonstrating that nearly all students experienced substantial score gains.

Students who initially scored 40 improved to 70–80, reflecting a substantial increase in understanding from the “very low” to the “good” category. Students with initial scores of 50 generally increased to 70–80, showing consistent progress. Those who started with 60 also reached 70–80, while students who initially scored 70 improved their scores up to 90.

Score improvements ranged from 10 to 40 points, with the greatest gains observed among students with initially low scores. These findings indicate that the applied learning method effectively supports students who previously struggled, helping them achieve better outcomes. Therefore, the implementation of this learning method can be considered effective in enhancing both understanding and learning achievement among students at SD Negeri Agom.

Discussion

The findings from the five elementary schools in Kalianda, South Lampung—SDN Kecapi, SDN Sidomakmur, SDN Way Lubuk, SDN Gunung Terang, and SDN Agom—demonstrate a consistent improvement in students' learning outcomes after the implementation of Augmented Reality (AR)-based learning interventions. Across all schools, Pre-Test scores ranged from 40 to 70, indicating that many students initially had low to moderate mastery of English materials. After the learning intervention, Post-Test scores increased to ranges between 60 and 90, demonstrating substantial gains in both understanding and retention of English language concepts (Fauziyah, Sugiman, & Munahefi, 2024; Tyson, 2021).

From the AR perspective, these results highlight the effectiveness of interactive and immersive learning technologies in enhancing student engagement and comprehension. AR provides multi-sensory experiences that make abstract concepts more concrete, which aligns with findings from Chhabhaiya, Patle, and Bhojane (2024), who note that virtual and augmented reality applications can improve learning by integrating visual, auditory, and kinesthetic modalities. In SDN Kecapi, for example, students with Pre-Test scores of 40 were able to achieve 70 on the Post-Test, demonstrating how AR can bridge initial learning gaps (Mustaqim, 2016). Likewise, at SDN Agom, students with initially low scores experienced the greatest gains, up to 40 points, suggesting that AR is particularly effective in supporting learners who require additional scaffolding (Putra, I.N.T.A., Kartini, & Abenk, 2024).

These consistent improvements indicate two key points. First, AR enhances both understanding and retention by providing interactive, context-rich experiences that traditional methods may lack (Fauziyah et al., 2024; Tyson, 2021). Second, the degree of improvement varies according to initial student proficiency. Students who started in the medium range (60–70) generally reached the “good” or “very good” categories, while those starting from lower baselines achieved the largest relative gains. This supports previous research on differentiated learning, showing that AR can

accommodate individual learning needs effectively (Hartati, 2022; Shadieff & Huang, 2016).

Furthermore, no students experienced a decline in scores across any of the schools, indicating that AR-based learning interventions provide a supportive and safe learning environment that fosters active engagement and experimentation (Gottschalk, 2019; Hallas, 2008). Post-Test scores ranging from 60 to 90 also show that AR supports both remedial learning for low-performing students and enrichment for higher-performing students (Rahma, Harjono, & Sulisty, 2023; Chhabhaiya et al., 2024). These outcomes align with studies emphasizing that AR not only increases student motivation but also promotes long-term retention and conceptual understanding (Tyson, 2021; Fauziyah et al., 2024; Usholih & Wardianto, 2017).

In conclusion, implementing AR in English language instruction for third-grade students effectively enhances both comprehension and retention. The observed score improvements, ranging from 10 to 40 points, indicate that AR makes abstract content tangible, interactive, and memorable. Consequently, AR is a valuable instructional tool that supports differentiated learning, engages students actively, and fosters meaningful learning gains across diverse proficiency levels (Chhabhaiya et al., 2024; Putra & Aswandi, 2023; Kusuma & Apriyanto, 2018).

CONCLUSION

Based on the findings and discussion, it can be concluded that the implementation of Augmented Reality (AR) in English language instruction for third-grade students at elementary schools in Kalianda, South Lampung, has a significant positive impact on students' learning outcomes. Across all five schools—SDN Kecapi, SDN Sidomakmur, SDN Way Lubuk, SDN Gunung Terang, and SDN Agom—students demonstrated consistent improvements in Post-Test scores compared to their Pre-Test results, with score gains ranging from 10 to 40 points. These improvements indicate that AR effectively enhances both comprehension and retention of English materials, enabling students to progress from low or medium proficiency levels to higher achievement categories.

The study confirms that AR provides an interactive and immersive learning environment, which facilitates multi-sensory engagement and concretizes abstract concepts, thereby supporting students' understanding and long-term retention. Moreover, AR proves to be an effective tool for differentiated instruction, accommodating diverse student needs by enabling lower-performing students to achieve substantial gains while also supporting enrichment for higher-performing students.

In addition, the absence of score declines across all participating students indicates that AR-based learning creates a safe and motivating educational environment that encourages active participation, exploration, and engagement. Consequently, AR is not only a powerful medium for improving academic performance but also a strategic tool to foster meaningful, student-centered learning experiences that promote long-term retention and conceptual mastery.

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