

# The Effect of Augmented Reality Based Learning Strategy on EFL Students' Vocabulary Mastery

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## A B S T R A C T

This study aims to examine the effect of an Augmented Reality (AR)-based learning strategy on EFL students' vocabulary mastery. Conducted at Thammasat Wittaya School, Thailand, the research involved 25 eighth-grade students in the 2024/2025 academic year, divided into experimental and control groups using a quasi-experimental design. The experimental group received vocabulary instruction through AR visuals and collaborative discussions, while the control group was taught using conventional methods. Data were collected using pre-tests and post-tests and analyzed using paired and independent t-tests. The findings revealed a significant improvement in vocabulary scores and student motivation in the experimental group compared to the control group ( $p < 0.001$ ). These results suggest that integrating AR-based strategies in EFL classrooms can effectively enhance vocabulary acquisition and learner engagement.

**Keywords:** *Augmented Reality (AR), EFL learners, vocabulary mastery, digital learning strategy.*

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## INTRODUCTION

The rapid advancement of technology has significantly influenced the field of education, especially in improving teaching methods and learning experiences. Digital innovations such as interactive platforms and personalized learning tools enable students to engage with content more effectively. As noted by Susilo et al. (2023), technology supports flexible and adaptive learning that can enhance student motivation and outcomes.

One of the most promising technological advancements in education is Augmented Reality (AR). AR overlays digital content onto the physical environment, allowing users to interact with three-dimensional objects in real time (Mukhtar & Fachrie, 2024 and Riar et al., 2021). This creates immersive learning experiences, enabling students to visualize complex concepts and engage in contextual learning. In language education, especially in vocabulary learning, AR has the potential to bridge the gap between abstract words and real-world application through interactive visualizations and simulations (Aslam & Davis, 2024 and Hung & Yeh, 2023).

Vocabulary mastery is a critical component in English as a Foreign Language (EFL) learning. Without sufficient vocabulary knowledge, students struggle to express ideas, understand content, and participate in meaningful communication (Josafat et al., 2021). However, traditional vocabulary instruction, often limited to memorization and textbook-based tasks tends to be monotonous and fails to support long-term retention (Chen & Liu, 2020). Learners frequently forget newly introduced words, especially when they lack contextual exposure and reinforcement.

AR-based learning offers a solution to this challenge by providing multisensory, contextual, and interactive environments. Through AR, learners can visualize 3D objects, simulate real-life settings, and associate words with actions or items in their surroundings. This active engagement supports stronger memory encoding and retrieval (Sahin & Yilmaz,

2020). Furthermore, the integration of gamification elements in AR can increase motivation and reduce anxiety, which are often barriers to effective language learning (M. Al Zahrani & Chaudhary, 2022).

As English continues to serve as a lingua franca in global communication (Barbara, 2020), the need for effective and engaging language learning methods becomes increasingly important. The use of AR in EFL learning represents an innovative approach that aligns with 21st-century educational demands. However, challenges remain, including the availability of infrastructure, teacher readiness, and the risk of overemphasizing entertainment over pedagogy (Wahyuanto & Hastuti, 2024).

Given these considerations, this study aims to investigate the effect of Augmented Reality-based learning strategy on EFL students' vocabulary mastery. The research seeks to determine whether AR can significantly improve vocabulary acquisition compared to traditional learning methods. The findings are expected to contribute to the body of knowledge in educational technology and provide practical recommendations for implementing AR in language classrooms.

### **The Effect in Educational Contexts**

In educational research, the term effect refers to measurable changes resulting from a specific intervention. (Hernán & Robins, 2016) highlight that the magnitude of an effect may vary depending on other influencing variables. In this study, the focus lies on how an Augmented Reality-based learning strategy affects EFL students' vocabulary mastery. For instance, (Özeren & Top, 2023) found that students using an AR-based science application (CellAR) performed significantly better in terms of academic achievement and motivation than those in traditional learning settings.

### **Learning Strategies in EFL Instruction**

Learning English as a Foreign Language (EFL) requires strategic approaches to enhance student engagement and promote long-term retention. Effective teaching strategies serve not only to deliver content but also to activate students' cognitive and emotional involvement in the learning process.

One widely supported approach is active learning, which emphasizes student participation through activities such as cooperative learning, discussions, and role-plays. Freeman (2020) stated that active learning enhances student engagement and critical thinking skills. However, practical challenges such as time constraints and varying levels of enthusiasm among students must be considered.

The learning strategy implemented in this study combines both cognitive and social strategies. Through Augmented Reality, students engaged with 3D visual representations of animals, enabling them to observe and describe key physical characteristics such as body parts, size, and shape. Although the AR content was limited to visuals and did not include information on diet or habitat, these aspects were explored through group discussions guided by the teacher or supporting materials.

In each group, students were encouraged to collaborate by identifying and describing at least one feature of the animal they observed. For example, one student might describe the animal's appearance, while others discussed what it eats or where it lives, based on prior knowledge or textbook information. This combination of visual processing and peer interaction supports both cognitive and social language learning strategies, enhancing vocabulary comprehension in a contextualized and engaging way.

### **Technology Integration in EFL Learning**

The integration of digital tools has significantly transformed EFL instruction. According to Fortuna et al., (2023) and Hillmayr et al., (2020), digital platforms and media not only facilitate access to learning materials but also enhance interactivity and engagement. Tools such as Duolingo or Moodle exemplify how technology supports personalized and collaborative learning experiences.

Nurhidayat et al., (2023) emphasized that technology can shift classroom dynamics from teacher-centered to student-centered. Teachers can use online platforms for collaborative

tasks, multimedia for visualization, and adaptive learning systems to tailor instruction to individual needs.

Among these innovations, Augmented Reality (AR) stands out for its immersive capabilities. AR overlays virtual objects onto real environments, allowing learners to interact with 3D models, hear pronunciations, and see words used in context (Mardoyo et al., 2022 and Rinaldi et al., 2024). AR not only bridges abstract language concepts with tangible experiences but also supports student creativity and reduces language learning anxiety.

### **Challenges in Vocabulary Acquisition**

Despite its importance, vocabulary acquisition remains a major challenge for many EFL learners. Common difficulties include: (1) Limited vocabulary size, which affects reading comprehension and academic performance (Soto-Corominas et al., 2020). Students often have limited vocabulary, which not only hinders their understanding and effective use of English but also interferes with the process of achieving basic competencies and learning outcomes. (2) Pronunciation and intonation problems, often due to mother tongue interference (Handayani, 2024; Xue, 2023). The influence of the mother tongue often affects the way students understand and use English vocabulary, which can lead to errors in word usage and sentence structure. (3) Lack of practice in real-world contexts, and Monotonous, resource-limited teaching methods (Pateşan et al., 2019). Lack of opportunities to practice English in everyday contexts limits students' ability to master vocabulary effectively. Limited practice can hinder the vocabulary acquisition process.

These challenges underscore the need for engaging, context-rich, and interactive strategies such as AR-based learning, that can make vocabulary instruction more effective and enjoyable.

## **METHOD**

This study employs a quantitative approach with a causal research design, aiming to determine the effect of Augmented Reality (AR)-based learning on improving EFL students' vocabulary mastery. The research focuses on identifying whether the use of AR as an independent variable significantly influences the dependent variable, which is students' vocabulary mastery. The study utilizes two data collection techniques: pre-test and Post-Test which together provide a comprehensive understanding of the effect of AR on students' learning outcomes.

### **Participants**

The subjects of this research are eighth-grade students of Thammasat Wittaya School in the academic year 2024/2025. This study applies a quantitative method with a quasi-experimental design, involving two groups: an experimental class and a control class. The total number of students is 25, with both groups selected from the same grade level.

The experimental group receives vocabulary instruction through augmented reality-based learning strategies, while the control group is taught using conventional learning methods. The classes are selected using purposive sampling, considering that the students have relatively similar levels of English proficiency and are taught by the same English teacher.

### **Instruments**

#### *Pre-Test*

The pre-test was designed to measure students' initial mastery of animal vocabulary before the application of Augmented Reality (AR)-based learning. It consisted of 10 multiple-choice questions that assessed students' knowledge of animal names, physical characteristics, and habitats. The test was administered at the beginning of the study to determine the students' baseline understanding of the target vocabulary.

#### *Augmented Reality (AR)-Based Learning*

Following the pre-test, students were invited to access the AR content, which contained 3D models and interactive animations related to the animals studied. The AR content was accessed through barcodes or links provided by the researcher. During the AR learning sessions, students observed various images and English names of animals and paid attention to their characteristics as displayed in the visual content to enhance vocabulary

comprehension. The researcher randomly asked each student to say one word that described the animal they observed.

#### *Post-Test*

After completing the AR-based learning sessions, students took a post-test to measure their improvement in vocabulary mastery related to animals. The post-test was administered in the same format as the pre-test to allow for a direct comparison of vocabulary mastery before and after the intervention.

#### **Procedures**

This research employed quantitative data to examine the effect of augmented reality-based learning strategies on EFL students' vocabulary mastery. The procedures were conducted in the following stages:

##### *Preparation Stage*

The researcher designed learning materials integrated with Augmented Reality (AR) and prepared pre-test and post-test instruments to measure students' vocabulary mastery.

##### *Pre-Test Administration*

Prior to the implementation of the treatment, a pre-test was administered to both the experimental and control groups to assess their initial vocabulary mastery.

##### *Treatment (Implementation of AR-Based and Conventional Learning)*

The experimental group received instruction using Augmented Reality-based materials, which included interactive and visual elements to enhance vocabulary acquisition. The treatment was conducted over four weeks, with AR sessions held three times per week. Meanwhile, the control group was taught using conventional learning methods without the integration of AR. Both groups received instruction on the same vocabulary topics to ensure content equivalency throughout the study.

##### *Post-Test Administration*

After the treatment period, a post-test was administered to both groups to evaluate the improvement in vocabulary mastery. The data collected from the pre-test and post-test were analyzed to determine the effectiveness of the AR-based learning strategy compared to conventional methods.

#### **Data Analysis**

The analysis includes both descriptive and inferential statistical methods. Descriptive statistics are used to summarize and describe the characteristics of the data collected, including the average scores, standard deviations, and frequency distributions of both the pre-test and post-test results. Inferential statistics are employed to test hypotheses and determine the significance of the differences between the two sets of scores. A paired sample t-test is applied, as it compares the pre-test and post-test results from the same group of students to evaluate whether the use of AR led to a significant improvement in vocabulary mastery. Data processing was conducted using Microsoft Excel for data organization and SPSS version 29.00 for Windows for statistical analysis. This methodological approach ensures the reliability and validity of the findings in assessing the impact of Augmented Reality on enhancing EFL students' vocabulary learning outcomes.

## FINDINGS AND DISCUSSION

To examine the effect of augmented reality (AR)-based learning strategy on EFL students' vocabulary mastery, a pretest and posttest were administered to two groups: the experimental group and the control group. Below is the descriptive data of students' scores:

No	Name	Group	Pre Test	Post Test
1	PZ	Eksperimental	40	100
2	NK	Esperimental	50	100
3	MM	Eksperimental	80	100
4	AH	Eksperimental	70	100
5	SA	Esperimental	30	90
6	SIA	Eksperimental	50	100
7	YN	Eksperimental	40	90
8	AM	Eksperimental	60	100

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9	NN	Eksperimental	50	100
10	NO	Eksperimental	60	100
11	UA	Eksperimental	40	100
12	NH	Eksperimental	70	100
13	HA	Eksperimental	40	90
14	SR	Control	30	80
15	NA	Control	40	90
16	HH	Control	50	100
17	SH	Control	30	70
18	ME	Control	40	100
19	NA	Control	30	90
20	NE	Control	70	100
21	MH	Control	20	80
22	LA	Control	40	90
23	KN	Control	30	100
24	MH	Control	40	70
25	NB	Control	50	90

**Descriptive Statistics**

Based on SPSS analysis, the overall pretest scores from both groups (n = 25) had:

**Statistics**

PRETEST		
N	Valid	25
	Missing	0
Mean		46.00
Median		40.00
Std. Deviation		15.275
Minimum		20
Maximum		80

These statistics indicate that students' initial vocabulary mastery was relatively low and varied widely. The mean score of 46.00 shows the average performance, while the median (40.00) being lower than the mean suggests a slight skew towards higher scores by a few participants. The high standard deviation (15.275) indicates a wide dispersion in scores, meaning students had differing levels of vocabulary mastery at the start.

The posttest scores, meanwhile, revealed:

**Statistics**

POSTEST		
N	Valid	25
	Missing	0
Mean		93.20
Median		100.00
Std. Deviation		9.452
Minimum		70
Maximum		100

The post-test results show a substantial improvement. The mean increased from 46.00 to 93.20, reflecting an average improvement of 47.2 points. The median score reaching 100.00 also shows that more than half of the students scored perfectly or nearly perfectly. Moreover, the standard deviation decreased to 9.452, suggesting that students' scores became more consistent after the treatment. These results suggest a substantial improvement in vocabulary mastery after the treatment was applied.

**Paired Sample T-Test Result**

Paired Samples Test										
		Paired Differences					Significance			
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	One-Sided p	Two-Sided p
					Lower	Upper				
Pair 1	PRETEST - POSTEST	-47.200	12.423	2.485	-52.328	-42.072	-18.997	24	<0.001	<0.001

The paired samples t-test showed a p-value (Sig. 2-tailed) = 0.001, which is significantly lower than 0.05. This indicates that the difference in scores between pretest and posttest is

statistically significant. Thus, the AR-based learning strategy contributed meaningfully to the students' vocabulary improvement.

The experimental group that received vocabulary instruction through AR tools consistently showed significant improvement. Almost all students in the experimental group scored 90 or above in the posttest. In contrast, while the control group also showed some improvement, the increase was not as uniform or as high. This suggests that AR-based learning provided interactive and immersive experiences that facilitated better vocabulary acquisition.

The findings are consistent with previous studies that highlight the effectiveness of AR in language learning contexts. It promotes student engagement and supports memory retention by offering contextual learning environments.

## CONCLUSIONS

The findings of this study demonstrate that the use of augmented reality-based learning strategy has a positive and significant effect on EFL students' vocabulary mastery in . The experimental group, which was exposed to AR-based instruction, showed remarkable improvements in their posttest scores compared to the control group. The paired t-test confirmed the significance of this difference. Thus, AR technology proves to be a valuable pedagogical tool in vocabulary learning, offering an innovative and effective approach to language education.

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