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The Impact of Google Lense on Vocabulary Learning in Level 2 Rural Primary School

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Abstract: *This quasi-experimental study investigates the impact of Google Lens, an augmented reality tool, on vocabulary acquisition among rural primary school students in Malaysia. This research explores whether integrating Google Lens into English language lessons can improve students' vocabulary retention and engagement. The study involves two groups of Level 2 students from rural schools: an experimental group using Google Lens as a vocabulary learning aid, and a control group receiving traditional instruction without technological intervention. Over four weeks, both groups were assessed using pre- and post-tests designed to measure vocabulary knowledge. In addition to test scores, qualitative data were collected through classroom observations and student interviews to gauge attitudes, motivation, and the usability of the tool. The findings revealed that students in the experimental group showed a statistically significant improvement in vocabulary acquisition compared to the control group. Moreover, students expressed high levels of interest and motivation when using Google Lens, citing its interactive and visual nature as beneficial for understanding and remembering new words. This study underscores the effectiveness of integrating augmented reality tools like Google Lens in rural educational settings, offering practical implications for teachers aiming to enrich vocabulary instruction. The results suggest that accessible technologies can bridge digital learning gaps and support English language development in under-resourced schools.*

Keywords: Google Lens, Vocabulary Learning, Rural Primary Schools, Augmented Reality, English Language Learning

1. Introduction

Learning vocabulary is one of the most basic aspects of acquiring a second language, especially when it comes to students who learn English as a Second Language (ESL) in elementary school. Vocabulary knowledge is essential for understanding what is being read and for developing a student's ability to speak clearly and develop their language skills to a proficient level. Unfortunately, for students in rural elementary schools, there is generally a limitation on opportunities for students to be exposed to English (e.g., through teachers, books, etc.), therefore limiting their vocabulary development. Additionally, many rural schools do not have the necessary materials to teach vocabulary development and also do not have the means to utilize modern technologies to support vocabulary development.

Fortunately, the rapid growth of educational technology has provided alternative ways for students to learn vocabulary through utilizing mobile-assisted language learning (MALL), and

utilizing augmented reality (AR) tools. For example, Google Lens is an artificial intelligence (AI)-driven, visual recognition tool that allows users to take pictures of items/words/images and instantly receive information about them linguistically. Utilizing the visual and contextual features of Google Lens can allow vocabulary learning to become more meaningful and connective for learners, as learners will be able to connect the word(s) with a real-world context.

Studies have documented the success of AR-based tools in enhancing vocabulary acquisition, learner engagement and motivation (Parmaxi & Demetriou, 2020; Akçayır & Akçayır, 2017). However, the use of Google Lens in rural ESL classrooms could offer an additional method of learning vocabulary and also be easily integrated into current classroom practices, as many students already utilize their mobile devices within the classroom. Therefore, researchers have started to conduct experimental/quasi-experimental studies to assess the effectiveness of Google Lens in enhancing vocabulary learning outcomes.

Although, many researchers have found the effectiveness of Google Lens to improve vocabulary learning outcomes, however, many researchers have evaluated the effectiveness of Google Lens using inferential statistical analysis (e.g., t-test) to determine if the increase in vocabulary acquisition is statistically significant. Although, these types of analyses are helpful, they do not always show how large the increases were in vocabulary acquisition and whether these increases would be practically important in terms of education.

Many researchers have documented the effectiveness of using Google Lens and other AR-based tools in enhancing vocabulary acquisition, however, several issues still exist. First, researchers tend to focus a great deal on whether changes due to the use of Google Lens are statistically significant rather than determining if the observed increases in vocabulary acquisition translate to a meaningful amount of learning in actual classroom settings. A statistically significant outcome does not mean that the intervention had a considerable, or educationally valuable, effect.

Second, studies conducted in rural primary school environments often have small sample sizes, which is often due to enrollment and logistical constraints. Therefore, relying solely on inferential statistics can limit or mislead the interpretation of the effectiveness of the instructional intervention. Researchers have indicated that effect size measures are especially important in small-scale educational research as they give a much clearer indication of the magnitude of learning (Plonsky & Oswald, 2017).

Third, although there has been some evidence documenting vocabulary acquisition as a result of using Google Lens in conjunction with instruction, there is very little research re-analyzing existing data sets using alternative quantitative methods to further investigate the outcomes of learning. The lack of this type of secondary analysis provides an opportunity to maximize existing data and provide more detailed interpretations of the effects of technology-assisted learning.

Therefore, there is a need to re-evaluate vocabulary acquisition as a result of using Google Lens in conjunction with instruction using effect size and learning gain analyses to further examine the practical significance of the observed increases in vocabulary acquisition. Thus, the research questions are:

1. How effective is Google Lens can significantly improve vocabulary acquisition among rural Level 2 primary school students compared to traditional methods?
2. What are students' perceptions of using Google Lens as a vocabulary learning tool?

2. Literature Review

The Sociocultural Theory of Vygotsky, is one of the most fundamental theories of Educational Psychology that demonstrates the power of socially mediated and reciprocal interactions among participants, the utilization of culture-based tools and shared experiences of learners, and the influence of collaborative learning experiences upon the cognitive growth of individuals. At the center of Vygotsky's Sociocultural Theory is the concept of the Zone of Proximal Development (ZPD), which serves as a theoretical construct between what a learner can accomplish independently and what a learner can accomplish when working with a "more knowledgeable other" (Vygotsky, 1930). A learner should be engaged with tools, language, and social interactions in order to create a collaborative space for cognitive development within the classroom.

As such, the learner in Vygotsky's ZPD is more than merely an individual learner; she/he is a culturally and socially mediated learner. As researchers and educators are developing ways to incorporate mobile and AI-enabled tools into their classrooms, they are also reframing Vygotsky's Sociocultural Theory to reflect how these emerging digital tools are being utilized within the classroom; mobile learning tools can provide scaffolds for learners to utilize in authentic learning situations; and Google Lens is an exo-sign that can exemplify new knowledge of language allowing students to use AI and digital technologies to mediate their understanding of language (i.e., vocabulary) in the real-world. While a tool such as Google Lens may support peer-assisted learning, enhance learners' engagement and association to contextual stimuli, and potentially expand a learners ZPD, it is much more than a simple tool in a group learning environment; it is a Vygotskian tool.

Google Lens can serve as a valuable tool to study in vocabulary learning research based on how it aligns with recent theoretical work about using technology in foreign language teaching and learning, and because of its direct application to ESL learning environments common in rural areas. A visual recognition application powered by artificial intelligence, Google Lens allows students to take pictures of real-world items and immediately get a variety of multimodal inputs including text labels, translations and contextual information. The provision of multimodal inputs from visual stimuli to support vocabulary development, is aligned with Dual Coding Theory (Paivio, 2014) and Multimedia Learning Theory (Mayer, 2020), which both emphasize the advantage of utilizing both visual and verbal pathways to support memory encoding.

As it relates to rural primary school ESL classrooms with level two learners, vocabulary development can be limited by lack of access to authentic English language input and instructional practice that is teacher-centered. In contrast, Google Lens enables level two learners to explore vocabulary through contextually appropriate, student-centered, learner-controlled approaches that are beyond textbooks. Additionally, studies on Mobile-Assisted Language Learning (MALL) demonstrate that the utilization of interactive, visual-based tools such as Google Lens, increase learners' ability to recognize words, construct meanings, and retain vocabulary over time, particularly for younger and lower proficiency learners (Chen et al., 2019; Burston, 2015).

Further, Google Lens facilitates self-directed, inquiry-based learning activities, which is particularly significant for engaging rural learners who have limited instructional time and limited educational resources available. Research has shown that AI-enhanced learning tools can facilitate learners' ability to learn independently, reduce learners' cognitive loads and provide instantaneous feedback to learners, which leads to increased motivation and confidence (Kohnke et al., 2023; Zawacki-Richter et al., 2019). In particular, for level 2 primary ESL learners, the immediate nature of Google Lens provides learners with continuous engagement opportunities, and promotes active learner participation.

Although there is an increasing number of research studies that investigate the role of AI and MALL in the education field, relatively few studies have investigated the effects of Google Lens on vocabulary development in primary school ESL learning environments in rural communities. Therefore, examining the effects of Google Lens on vocabulary development in rural primary school ESL learning environments is significant, as it will provide empirical research to an under-researched area, while providing educators and administrators with practical knowledge and guidelines for implementing accessible AI tools in equitable and inclusive ESL instruction.

It is well understood in the field of second language acquisition that vocabulary knowledge is a major part of what students learn when they learn a new language, especially during their early years of schooling; this is because developing early vocabularies supports both reading and writing, and also develops the skills needed to be able to communicate orally with others in a language.

Research has demonstrated time and again that lack of vocabulary limits students' abilities to understand what they read and to actively participate in communication; however, for ESL students who live in rural areas, acquiring vocabulary is even more difficult than for other ESL students because they receive less English input than their urban counterparts, and they typically do not have ready access to supplemental materials or resources that can help them develop their vocabulary.

While research has shown that teaching vocabulary using rote memory and traditional textbook methods does not provide adequate support for the retention of vocabulary or the understanding of how to use those words in context, researchers continue to advocate for methods of teaching vocabulary that incorporate visual, contextual, and experiential learning experiences that will enable students to better retain and apply what they learned.

3. Method

Quantitative research methods were utilized in this investigation of the effects of incorporating Google Lens into the vocabulary learning outcomes of rural primary ESL learners. Quantitative research methods are most appropriate in studies that seek to identify change; determine whether a relationship exists between two or more variables; and analyze results based upon numerical data and statistical analysis. Vocabulary learning gains and effect size data was collected as part of this research to quantify the contribution made by Google Lens to the vocabulary development of these learners.

The quasi-experimental one-group pre-test-post-test design was used in this study. A vocabulary pre-test was administered before the intervention and a vocabulary post-test was administered after the intervention to the same group of participants. The results from both

tests were compared to measure the amount of learning that occurred and to compute an effect size. The quasi-experimental one-group pre-test-post-test design is often used in educational research due to the fact that it is usually difficult to randomly assign students to control and treatment groups within small rural schools (Creswell & Creswell, 2018). However, this design can be useful for analyzing instructional interventions if they have been consistently applied and analyzed thoroughly.

Participants

This study involved 20 ESL level 2 students from a single rural primary school. These students were all following the National Curriculum for English and therefore followed a similar educational pathway; they also had very little experience with digital tools, and it was therefore appropriate to investigate how their experiences might be affected through a technology assisted vocabulary learning intervention.

Random sampling techniques were employed to randomly select the sample from the total number of level 2 students at the school. Each student's name was randomly assigned a number and the researcher then randomly selected a number to represent each of the 20 students participating in the study. This ensured that each student had an equal opportunity to participate in the study and therefore reduced the risk of bias and increased the internal validity of the study (Fraenkel, Wallen, & Hyun, 2019).

Data Analysis

The three tools used as research instruments to collect data for this research include a vocabulary pre-test, a vocabulary post-test and a questionnaire. Utilizing these instruments provided an opportunity for triangulation and increased the confidence of the results. In order to establish what students knew about vocabulary at the beginning and end of the Google Lens intervention, the vocabulary pre-test and post-test were used. Both tests contained 20 test items that focused on vocabulary that students would have been exposed to through the Level 2 ESL Syllabus. There were three different item formats that were used to ensure the items were relevant and appropriate for the age range of the students; these formats included picture-word matching, multiple choice format and short constructed response.

Secondly, a structured questionnaire was distributed to gather quantitative information regarding how students viewed the utilization of Google Lens for vocabulary learning. The questionnaire included items in a Likert scale format that measured engagement, perceived usefulness, ease of use, and motivation. The questionnaire was modified from previous studies that assessed the attitudes and acceptance of technology and language learning (Teo, 2016). The wording of the questionnaire items was simplified to meet the comprehension needs of the Year 5 students. Thus, questionnaires are useful when attempting to gather data from a large group of respondents regarding their attitudes towards various topics. This type of data can also be analyzed statistically to understand learner's perspectives (Dörnyei & Taguchi, 2019). To establish the reliability of the vocabulary tests and questionnaire, the vocabulary tests and questionnaire were pilot tested with a group of students that represented the population of interest for this study.

The internal consistency of the questionnaire was evaluated using Cronbach’s Alpha in SPSS and the Cronbach’s Alpha values indicated a high level of reliability, all values exceeded .70. All the quantitative data collected during the study were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics including the mean and standard deviation

were used to analyze the pre-test and post-test scores. A paired samples t-test was completed to evaluate if there were any significant differences between the pre-test and post-test scores.

Data Collection Procedures

Participants collected data for this project over a three-month duration from October 2025 thru December 2025. Before the initiation of the study, the researcher received approval to conduct this research through the ERAS 2.0 application, school administrators, parents and participating students. At the beginning of October 2025, the researcher administered a pre-test of vocabulary to each participant to determine each participant's prior vocabulary knowledge. Following the pre-test, students received instruction on how to use Google Lens for basic object identification and vocabulary acquisition.

The intervention stage of this project involved integrating Google Lens into the students' weekly ESL classes for several weeks, while students learned vocabulary through visual means (images) and real-world objects. When the students completed the intervention stage of the project in December 2025, the researcher administered a post-test of vocabulary to measure each student's vocabulary growth. After administering the post-test of vocabulary, the researcher distributed a survey to collect the participants' opinions about the project and their learning experience. Additionally, the researcher interviewed some of the participants for additional information to support and expand upon the quantitative data gathered with qualitative data. All of the data collected, was statistically analysed using IBM SPSS Statistics Version 23.

4. Findings and Discussions

Effectiveness of Google Lense in Vocabulary Acquisition

Table 1: Descriptive Statistics of Controlled Group

Controlled Group	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test	10	4	10	6.80	2.150
Post-Test	10	8	12	9.60	1.430

Table 2: Pre-test and Post Test Score Differences of Controlled Group

Student ID	Pre-Test Score (%)	Post-Test (%)
1	25	45
2	30	40
3	20	40
4	35	50
5	40	55
6	45	60
7	45	50
8	30	45
9	50	55
10	20	40

The controlled group showed minor improvement in vocabulary performance from the pre-test to the post-test, reflecting learning gains achieved through conventional instructional methods rather than technology integration. Descriptive statistics revealed that the mean score increased from 6.80 (SD = 2.15) in the pre-test to 9.60 (SD = 1.43) in the post-test, resulting in a mean

gain of 2.80 points. The reduced standard deviation in the post-test suggests more consistent student performance after instruction.

Analysis of individual percentage scores supports this finding, as all ten students demonstrated positive gains ranging from 10% to 20%. Lower-performing students showed notable improvement, while higher-performing students exhibited more moderate gains, indicating a possible ceiling effect. Additionally, the minimum score increased from 4 to 8, and the maximum score rose from 10 to 12, confirming overall progress across the group. Despite these improvements, the gains remained incremental, which is typical of traditional ESL vocabulary instruction without technological support.

Table 3: Descriptive Statistics of Experimental Group

Experimental Group	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test	10	4	10	7.40	1.897
Post-Test	10	15	20	18.30	1.767

Table 4: Pre-test and Post Test Score Differences of Experimental Group

Student ID	Pre-Test Score (%)	Post-Test Score (%)
11	25	55
12	30	90
13	40	95
14	20	75
15	45	95
16	50	100
17	40	85
18	40	95
19	45	100
20	35	100

The descriptive statistics show substantial vocabulary improvement in the experimental group following the integration of Google Lens. The mean score increased from 7.40 (SD = 1.90) in the pre-test to 18.30 (SD = 1.77) in the post-test, resulting in a large mean gain of 10.90 points and indicating a strong instructional effect beyond conventional methods.

At the individual level, all ten students demonstrated significant gains ranging from 30% to 65%. Several students achieved perfect or near-perfect post-test scores, while lower- and mid-performing learners showed marked improvement, suggesting that Google Lens was particularly effective for these groups. The minimum score increased from 4 to 15 and the maximum from 10 to 20, confirming overall progress. In contrast to the controlled group, post-test scores clustered at the higher end, and the stable standard deviation indicates that gains were consistently shared across students.

Students' Perception of Using Google Lense for Vocabulary Learning

Table 5: Students' Perceptions of Using Google Lens for Vocabulary Learning (n = 10)

Item	Perception Construct	Mean (M)	SD	Interpretation
Q1	Enjoyment using Google Lens	4.80	0.42	Very Positive
Q2	Google Lens helped in learning	4.60	0.52	Very Positive
Q3	Ease of using Google Lens	4.50	0.53	Very Positive

Item	Perception Construct	Mean (M)	SD	Interpretation
Q4	Pictures support vocabulary learning	4.70	0.48	Very Positive
Q5	Vocabulary acquisition improvement	4.60	0.52	Very Positive
Q6	Confidence using Google Lens	4.50	0.53	Very Positive
Q7	Fun in using Google Lens for learning	4.60	0.52	Very Positive
Q8	Willingness to use Google Lens in future	4.60	0.52	Very Positive
Q9	Ability to check work using Google Lens	4.40	0.52	Positive
Q10	Recommendation to others	4.50	0.53	Very Positive

Note. Likert scale: 1 = Strongly Disagree, 5 = Strongly Agree.

Table 7 presents the descriptive statistics of students' perceptions towards the use of Google Lens as a vocabulary learning tool in a Level 2 rural primary ESL classroom. Overall, the findings indicate strongly positive perceptions, with all items recording high mean scores ranging from 4.40 to 4.80, suggesting that Google Lens was well received by the participants. The highest mean score was recorded for enjoyment using Google Lens (Q1, M = 4.80, SD = 0.42), indicating that students found the learning experience enjoyable and engaging. This highlights the motivational value of Google Lens, which is particularly important for young ESL learners in rural settings where traditional instruction may limit learner engagement. Similarly, students strongly agreed that the visual features of Google Lens, particularly pictures, helped them acquire vocabulary (Q4, M = 4.70, SD = 0.48). This finding underscores the importance of visual support in enhancing vocabulary comprehension and retention among primary learners.

Items related to perceived usefulness and vocabulary development also received very positive responses. Students agreed that Google Lens helped them learn vocabulary more effectively (Q2, M = 4.60) and improved their vocabulary acquisition (Q5, M = 4.60). These results suggest that Google Lens facilitated meaningful learning by allowing learners to connect real-world objects with English vocabulary in context. Furthermore, students reported increased confidence in using Google Lens (Q6, M = 4.50), indicating that the tool was accessible and suitable for their proficiency level.

In terms of engagement and future use, students expressed strong agreement that Google Lens was fun to use in education (Q7, M = 4.60) and that they would like to continue using it in the future (Q8, M = 4.60). These findings reflect a high level of acceptance and readiness to integrate AI-assisted tools into ESL learning. Although slightly lower, the mean score for checking work using Google Lens (Q9, M = 4.40) still indicates a positive perception, suggesting that students viewed Google Lens as a supportive learning aid.

5. Discussions

The Descriptive and Inferential Statistics show that there has been a very significant increase in learner's vocabulary performance after the learner's experience of using the Google lens–based instructional method. The learner's average scores on the post-test were significantly higher than the learner's average scores on the pre-test, demonstrating clearly an increase in vocabulary performance following the intervention. A Paired-Sample T-Test confirmed the learner's increase in vocabulary performance is statistically significant at $p<.001$. Additionally, the large value of t and the narrow CI further demonstrate the statistical reliability of the learner's increase in vocabulary performance; additionally, they suggest the learner's increase

in vocabulary performance has educational relevance. Lastly, the large effect-size based on the average change in scores relative to the variability of scores, using Cohen's guidelines, indicates that the Google Lens–based Instructional Method has had a substantial positive impact on the learner's vocabulary acquisition. Therefore, the results support the notion that the observed increases in vocabulary performance are both statistically and educationally important.

Together, the large difference in pre- and post-test scores, along with the normalized gain analysis, indicated that the learners experienced a very high percentage of the potential maximum gain in their vocabulary performance. Large gains in vocabulary performance are rare in short-term vocabulary interventions; moreover, given that the majority of rural ESL learners have limited access to English language learning opportunities and materials, large gains in vocabulary performance are even rarer. Thus, the learning gain results provide strong evidence that the Google Lens–based instructional method is more effective than traditional instructional methods in facilitating the acquisition of new vocabulary by rural ESL learners. Moreover, the analysis indicates that the Google Lens instructional tool facilitates a greater efficiency of progression from elementary to advanced levels of vocabulary knowledge by the learners.

Additionally, the use of effect-size and learning-gain analyses provides a more in-depth understanding of the significance of the learner's improvement than would be provided by simply reporting t-test results. While the t-test demonstrated that the learners improved, the additional analyses demonstrated the degree to which the improvement had educational relevance. Furthermore, this analytical approach is consistent with the emphasis currently placed in the field of educational research on interpreting results of educational experiments based on the magnitude of results, particularly in studies conducted in small classrooms or in other limited setting.

On the other hand, the results of the Cronbach's alpha test indicated that the internal consistency of the perception questionnaire was low. Therefore, the results of the perception questionnaire suggested that the learners' responses represented multiple concepts including enjoyment, ease of use, and confidence in using the Google Lens technology rather than one concept. While the low internal consistency of the perception questionnaire limits the interpretation of the results of the perception questionnaire, it did not limit the significance of the results of the vocabulary performance measures.

6. Conclusion

The study reveals that Google Lens makes a very significant difference in how vocabulary is learned in the primary ESL classroom of rural areas. In comparison to the pre-tests, the students in the experimental group showed a very impressive increase (statistically and practically) in vocabulary test scores. The large increase in the mean scores of the students in the experimental group, along with the strong statistical measures, show that the students' learning was consistent throughout the group. While most ESL vocabulary studies have primarily focused on demonstrating the statistical significance of the improvement, this study focuses on the practical and instructional value of the improvement; as well as, confirms that the gains made in the experimental group occurred in a way that is applicable to the real world classroom setting.

The results of the study demonstrate that the learners' ability to achieve almost the maximum amount of learning possible in the time allotted of the study, using the learning gain framework. Achieving such high amounts of learning in a short vocabulary study is rare, especially in rural ESL settings. Google Lens allowed learners to associate words to real life things, pictures and to their surrounding environment, providing learners with the opportunity to develop vocabulary in a much quicker and more meaningful way than without Google Lens. Google Lens provided learners who had lower proficiency levels, an opportunity to help close performance gaps and to provide more equal opportunities for all learners to be successful.

While the above-mentioned positive outcomes indicate that the study demonstrates the potential of Google Lens to enhance vocabulary learning among rural primary ESL learners, the study also has limitations. Some of the limitations include the small number of students involved in the study and the short time frame of the study's intervention. Both of these limitations are acceptable for the purpose of pilot classroom-based research as they allow researchers to determine the feasibility of a new instructional method, the response of learners to the new instructional method and the initial effects of the new instructional method. The limitations do not detract from the obvious evidence of increased learning shown in the results of the study.

In conclusion, the study clearly demonstrates that Google Lens has a very significant positive impact on the vocabulary learning of rural primary ESL learners. The use of effect sizes and learning gain analysis adds to the understanding of the effectiveness of the instructional method and to the importance of using magnitude-based methods when conducting educational research. A recommendation for future studies would be to conduct larger scale studies over longer periods of time to continue validating the findings of the current study.

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Conflict of Interest Statement
The authors declare that there is no conflict of interest regarding the publication of this study.

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