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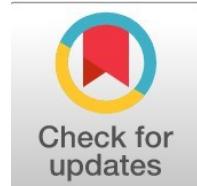
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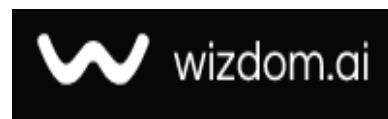
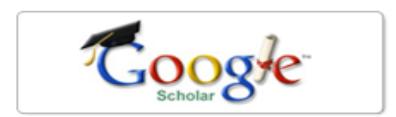
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Duolingo-Based Vocabulary Gains in Junior High EFL Learners

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Abstract

General Background Vocabulary mastery is a fundamental component of English as a Foreign Language learning and supports the development of listening, speaking, reading, and writing skills, particularly in secondary education contexts. **Specific Background** Alongside the growth of digital learning technologies, mobile applications such as Duolingo have been increasingly integrated into English Language Teaching due to their accessibility, gamification features, and interactive learning design. **Knowledge Gap** Despite growing interest, empirical classroom-based evidence focusing specifically on junior high school students' vocabulary mastery using Duolingo remains limited, especially within Indonesian EFL settings employing structured pre-test and post-test measurement. **Aims** This study aimed to examine whether the use of Duolingo as a digital learning medium contributes to measurable improvement in English vocabulary mastery among seventh-grade students. **Results** Using a quantitative pre-experimental one-group pre-test and post-test design involving 32 junior high school students, statistical analysis revealed a significant difference between pre-test and post-test scores, with a *Sig. (2-tailed)* value of 0.000, indicating notable vocabulary improvement after Duolingo-based instruction. **Novelty** The study provides focused empirical evidence on vocabulary mastery outcomes from Duolingo-supported instruction at the junior high school level within a classroom-based EFL context. **Implications** The findings suggest that Duolingo can serve as a supportive digital medium for vocabulary learning in secondary EFL classrooms and offer a practical reference for educators integrating mobile-assisted language learning into formal instruction.

Highlights:

- Statistically significant score differences were observed between pre-test and post-test measurements.
- Learner engagement increased during gamified digital learning sessions.
- Mobile application use supported structured vocabulary practice in classroom instruction.

Keywords: Duolingo, Vocabulary Mastery, EFL Learning, Junior High School, Mobile Assisted Language Learning

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Introduction

Recently, learning can be done anywhere and anytime [1], and some learning applications are starting to develop that make it easier for children to learn anywhere and anytime. Indonesian students learn English as a foreign language. Like many other languages, English has four primary skills: listening, speaking, reading, and writing. These four fundamental abilities are also connected by language elements like vocabulary, grammar and pronunciation. One factor that supports students in mastering language skills is vocabulary[2], [3] Octa said The learning of English as a Foreign Language (EFL) in Indonesia necessitates the mastery of four primary skills: listening, speaking, reading, and writing. These four fundamental abilities are interconnected with language elements such as vocabulary, grammar, and pronunciation. Vocabulary stands as one of the main supporting factors for students in mastering language skills, serving as a bridge to understanding and effectively learning the language. A strong command of vocabulary is crucial for improving the quality of learning from children to adults[4]. Vocabulary serves as a bridge to understanding and effectively learning language[5]. In this modern era, learning can be done anywhere and anytime. Various learning applications are being developed to facilitate an easier and more flexible learning process. Online language learning programs are becoming increasingly popular, making it essential for instructors and learners to evaluate their usefulness. The integration of technology into English Language Teaching (ELT) helps address the needs of digital-age learners. Research has shown significant improvement in learner performance when technology is used as a supplementary tool alongside traditional teaching methods. Online language learning programs like Duolingo are becoming more popular. Therefore, instructors and learners must evaluate their usefulness[6]. What the researchers has not done is to do a test where the vocabulary learned by all students is indispensable for further research with a more comprehensive test and test all the vocabulary learned, application researchers Duolingo, who had significant results in possession of the vocabularies for students rather than using old vocab cards, researchers also recommended that later researchers explore the effects on different levels of education using a larger scale template[7]. The theory refers to Nation's theory of vocabulary knowledge and Thornbury's theory of the importance of understanding vocabulary. There is also a theory of key about mobile application learning and a theory of Munday's use of Duolingo in language studies.

Technology for education or we may call it as learning technology as a field of cultivation, of course, is always faced with a systematic self-assessment process[8]. Duolingo is one such online language learning software tecnology for education that is effective for improving English language fluency. This application makes studying easier and increases student interest by offering a fun and engaging learning environment[9]. Duolingo is a free language learning application also available on the web, offering 66 different language courses in 23 languages. This application is suitable for beginners who want to learn English, allowing them to choose their desired level and progression, and catering to both educational needs and everyday use. Duolingo has gained significant attention in ELT due to its gamified approach to language learning, proving to be an effective tool for supporting foreign language acquisition, especially in mastering new English vocabulary. Gamification features like progress tracking, streak rewards, and fun animations enhance user engagement and intrinsic motivation, particularly for younger learners and beginners. It caters to both educational needs and everyday use. Duolingo's effectiveness in enhancing speaking and writing skills was limited, suggesting it is best used as a supplementary tool[10]

When using Duolingo, at the start of registration, users will be guided to select the language they want to learn, their reason for learning it, and their desired target, ranging from 3 to 30 minutes per day. Users can set their daily learning goals themselves. Once started, Duolingo's mascot, Duo, will appear in notifications to encourage users, reminding them to meet their English learning target daily. The lessons begin with easy vocabulary, followed by listening exercises for beginners. If users answer correctly, an animation within the app will applaud. If they answer incorrectly, an explanation of the correct answer will be provided, and one life will be deducted. After completing exercises according to their daily learning goal, users can claim daily rewards, which can be redeemed later.

Duolingo has gained significant attention in English Language Teaching (ELT) due to its gamified approach to language learning. It has been shown to be an effective tool for supporting foreign language acquisition, especially in mastering new English vocabulary[11][12][13], [14]. Research indicates that Duolingo can help learners improve both vocabulary and grammatical skills. For example, one study found that university students using Duolingo showed significant gains in vocabulary mastery compared to those using traditional methods[15]. The result showed that using Duolingo in EFL instruction provided a number of advantages, such as better vocabulary and grammatical mastery, improved speaking, listening, reading, and writing abilities, and higher student enthusiasm to study. The Duolingo received a fairly good rating, so this application can be said to help teachers as a mobile application-based learning medium [16]. Duolingo can employ gamification features like progress tracking, streak rewards, and fun animations to enhance user engagement. These features have been linked to increased intrinsic motivation, particularly for younger learners and beginners. Duolingo is explored as a tool for enhancing English language teaching (ELT) by providing a customizable, accessible platform that encourages effective learning. The research investigates its potential and challenges in improving reading comprehension skills among ESL students[17]

Although previous studies have demonstrated the effectiveness of Duolingo in teaching vocabulary, grammar, and language competency, a comprehensive examination of the intricate dynamics underpinning learners' motivation to communicate and ongoing engagement is still missing. Some prior research has not conducted a comprehensive test of all learned vocabulary, and there are recommendations to explore the effects of Duolingo at different educational levels using a larger scale. Furthermore, previous articles did not explicitly focus on the effectiveness of Duolingo in improving students' vocabulary skills, but rather on the broader impacts on EFL learners' willingness to communicate and their overall engagement in online classes. The necessity of Duolingo in English Language Teaching (ELT) lies in its ability to enhance language acquisition through gamification, accessibility, and personalized learning paths. Duolingo's interactive format motivates learners by incorporating rewards, challenges, and reminders, fostering consistent engagement. Studies suggest its

effectiveness in improving vocabulary, listening, and speaking skills, particularly for beginners, as it provides structured exercises and instant feedback on mistakes. Although previous studies have demonstrated the effectiveness of Duolingo in teaching vocabulary, grammar, and language competency, a comprehensive examination of the intricate dynamics underpinning learners' motivation to communicate and ongoing engagement is still missing. The article does not explicitly focus on the effectiveness of Duolingo in improving students' vocabulary skills. Instead, it primarily examines the broader impacts of Duolingo on EFL learners' willingness to communicate and their overall engagement in online classes[18]

Additionally, Duolingo supports diverse educational goals, from casual learning to test preparation, making it versatile for students and educators. Its alignment with technology-based learning approaches helps integrate modern tools into ELT, addressing the needs of digital-age learners. Research has shown significant improvement in learner performance when Duolingo is used as a supplementary tool alongside traditional teaching methods.

To address these research gaps, the problem in this research has been formulated into the following question: Does the Duolingo app help junior high school students become more proficient in English vocabulary? By investigating this query, the study seeks to provide insight into Duolingo's potential as a helpful tool for junior high school language learning.

Method

A. Research Design

This study employed a quantitative research approach with a pre-experimental design, specifically a one-group pretest-posttest design. The pre-experimental approach, which consists of a pre-test, treatment, and post-test, was used in this study. States that "the outcomes of pre-experimental research are determined by dependent variables and are not solely affected by independent variables. This occurrence is possible due to the absence of a control variable and the non-random selection of samples"[19].

| One-Group Pretest-Posttest Design | | |
|-----------------------------------|-----------|----------------|
| Pre-test | Treatment | Post-test |
| O ¹ | X | O ² |

[18] Description:

O1: Pre-test (before treatment is given)

O2: Post-test (after treatment is given)

X: Treatment

The Researchers calculated the different between two related samples using paired sample t-test. The paired sample t-test is a statistical method used in comparative hypothesis testing to assess whether there is a sign difference in the means of two paired samples before and after given treatment[20]. In the paired sample t-test, the data are dependent since every value in the first sample pairs with a value in the second sample. If the value of alpha (α) is less than 0.05, the the null hypothesis (H_0) is rejected and the alternatif hypothesis (H_a) is accepted[21]. The procedure for doing a paired t-test in SPSS 22 involves performing the following steps: Analyze, means, Paired samples t-test, enter data and click ok[22]

B. Data Collection Techniques

This study was carried out at a Mojokerto public junior high school. Purposive sampling was used to choose 32 seventh-grade kids as the participants. A quantitative pre-experimental design was used in the investigation. Research techniques rooted in positivism are known as quantitative methods, and they are employed to examine certain populations or groups. Purposive sampling was utilized in this study because it concentrated on a single seventh-grade class that was judged appropriate for the study's goals, even though sampling procedures are typically conducted at random.

The school was picked since it was still uncommon to utilize the Duolingo program as a teaching tool. When compared to other courses, the chosen class likewise had the lowest English scores. Pre-tests and post-tests were used during the four-week investigation. Vocabulary cards served as the control media, and Duolingo as the treatment medium. Independent statistical tests were employed to assess the data. Four sessions were held in order to collect the data. During the first week, the researcher observed the teaching process in the classroom and spoke with the English instructor on the content being taught. A pre-test was given at the end of the second week's session after the researcher had gone into the classroom and gone over the previous week's content. Using a projector, the researcher demonstrated how to use the Duolingo program during the third week of the study. After that, the students used their own smartphones to try using the program. The post-test was given at the conclusion of the session to gather final results after the researcher used Duolingo to teach the lesson "Schedule" (Part 3, Unit 10) in the fourth week.

1. Pre-test

The pre-test was administered to one class of 32 seventh-grade students who had been selected as participants. The researcher reviewed the topic of "Schedule" without using any applications and conducted a question-and-answer session. At the end of the lesson, students were asked to complete the pre-test to assess their initial vocabulary mastery, specifically on the topic of "Schedule."

2. Treatment

The researcher re-taught the topic of "Schedule" directly in the classroom and introduced the Duolingo application using the [ISSN 2714-7444 \(online\), https://acopen.umsida.ac.id](https://acopen.umsida.ac.id), published by [Universitas Muhammadiyah Sidoarjo](https://acopen.umsida.ac.id)

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classroom projector. The participants were then guided to complete exercises in the Duolingo application under Part 3, Unit 10. They also tried the application independently on their own devices. In this session, students completed one learning level. After this treatment session, they proceeded to take the post-test to determine their final vocabulary scores.

3. Post-test

To collect post-test scores, the researcher created a quiz using Google Form based on the topic "Schedule." The questions were adjusted to match or exceed the difficulty level of the related Duolingo content. After the learning session, students completed the quiz via Google Form to obtain their post-test results.

C. Data Analysis

To determine the differences in scores before and after the exam, a data analysis was conducted. The results of the study showed the scores before and after the exam. To assess how well Duolingo improves students' vocabulary acquisition, the researcher used statistical analysis, especially the Paired Sample Test using SPSS. The paired sample t-test is a statical method used in comparative hypothesis testing to asses whether there is a sign difference in the means of two paired samples before and after given treantment [20]. In the paired sample t-test, the data are dependent since every value in the first sample pairs with a value in the second sample. If the value of alpha (α) is less than 0.05, the the null hypothesis (H_0) is rejected and the alternatif hypothesis (H_a) is accepted[21].

Result and Discussion

A. Result

The purpose of the pretest was to establish a baseline understanding of the students' knowledge or skills before the intervention, and the results showed that many students scored below average. After that, a treatment was given to determine whether there was an improvement in the students' abilities. This treatment involved the use of the Duolingo application, which was expected to enhance the students' skills in the tested area. After the treatment, a post-test was conducted, and the students scored above average, indicating that the Duolingo application was highly effective in improving the students' skills.

1. Normality Test

To ensure that the data to be analyzed has a normal distribution, a normality test is conducted. The experimental class pretest-posttest data was tested for normality using the following procedure:

The Shapiro-Wilk test, the researchers use that test because of the sample of this study is under 50 subject. Normality tests is a statistical method widely known for its versatility in examining and comparing the distribution characteristics of two distinct groups, was used to conduct a thorough and meticulous normality test as part of the extensive and detailed research study conducted at SMP Negeri in Mojokerto to explore and assess the effectiveness of Duolingo as media a tool to improve student English vocabulary skills among a specific group of grade VI students. The main goal of the study was to determine whether the pretest and post-test scores associated with the use Duolingo media adhered to a normal distribution pattern, thereby establishing the crucial and foundational aspect of normality as an essential prerequisite.

Table 1. Normality Test

| | Kolmogorov-Smirnov^a Statistic | df | Sig. | Shapiro-Wilk Statistic | df | Sig. |
|-----------|---|-----------|-------------|---|-----------|-------------|
| Pre-Test | .147 | 32 | .076 | .935 | 32 | .055 |
| Post-Test | .188 | 32 | .006 | .931 | 32 | .042 |

From the normality test result in table.1, it shows than Kolmogorov-Smirnov the data obtained for the Experiment *Pre-test* is 0.055, and the Experiment *Post-test* is 0.042. That is, 0.055 and 0.042>0.05, so the data is declared not normally distributed because the value of 0.055 and 0.042 less than 0.05.

In the study conducted at SMP Negeri in Mojokerto, a normality test was performed to assess whether the scores obtained from using Duolingo followed a typical distribution pattern. This step was crucial to ensure the validity and reliability of the data analysis process. By confirming that the test scores exhibited a normal distribution, the researchers could proceed with confidence in analyzing the impact of Duolingo as media on students' vocabulary skills. The result of the normality test provided assurance that the data met the necessary criteria for statistical analysis, reinforcing the credibility of the study's finding

2. Hypothesis Test

The next stage is to test the hypothesis to determine whether the formulated hypothesis is true after the normalcy test has been completed. The purpose of this test is to determine whether the hypothesis is acceptable or unacceptable. The analysis approach employed was the non-parametric Wilcoxon Signed Rank Test, which was based on the normality test results that indicated the data was not regularly distributed. Finding out if there is a substantial difference between the mean scores is the goal of this test. Presented below are the findings from the hypothesis test:

Table 2. Uji Pired Sampel t-test

| | Mean | Std. Deviation | Paired Differences | | t | df | Sig. (2-tailed) |
|-----------------------------|---------|----------------|--------------------|---|---|----|-----------------|
| | | | Std. Error Mean | 95% Confidence Interval of the Difference | | | |
| Pair 1 Pre test – Post Test | -12.500 | 6.268 | 1.045 | -14.621 – 10.379 | - | 32 | .000 |

The Wilcoxon Signed Rank test result revealed a significance value (Sig. 2-tailed) of 0.000, below the 0.05 cutoff. This indicates that the null hypothesis (H_0), according to which the scores from the pre-test and post-test do not change significantly, is rejected. It is decided to embrace the alternative hypothesis (H_1). Therefore, it can be said with certainty that junior high school pupils' comprehension of English vocabulary is enhanced by the Duolingo program. The study's research question is explicitly addressed by this outcome.

The research conducted at SMP Negeri in Mojokerto demonstrated the potential of Duolingo as an effective tool for improving vocabulary mastery among seven-grade students. Over the course of two sessions, the study observed a significant improvement in students' vocabulary performance. Each session included several learning phases, starting with a pre-test to assess students' baseline understanding, followed by treatment using the Duolingo application, and ending with a post-test to measure the effectiveness of the intervention.

Following the completion of the required analytical tests, such as normality tests to make sure the data satisfied statistical standards, the hypothesis test was carried out to assess how using animated video media affected the listening skills of the students at SMP Negeri in Mojokerto. If there was a significant difference between the pretest and posttest mean scores, it was assessed using the paired sample t-test. Based on the hypothesis test results, the alternative hypothesis (H_1) was accepted and the null hypothesis (H_0) was rejected with a significant value (2-tailed) of 0.000, which was below the 0.05 threshold. The comparison of scores before and after the intervention showed that the usage of Duolingo as media for vocabulary mastery in junior high school level, the results of the hypothesis test offered compelling proof of the value of using animated video content in English language instruction.

B. Discussion

During the pre-test, students' initial vocabulary comprehension was assessed through 20 multiple-choice questions, which indicated a moderate level of vocabulary mastery before the intervention. The treatment phase involved two 40-minute sessions where students engaged with interactive learning activities using the Duolingo application, focusing on vocabulary related to time and schedules.

The post-test results showed a significant improvement. This increase in scores suggests that students' vocabulary mastery improved with the use of the Duolingo application. The paired sample t-test further supported these findings, indicating a statistically significant difference between the pre-test and post-test scores. The null hypothesis, which stated that there was no difference between pre-test and post-test scores, was rejected in favor of the alternative hypothesis, confirming the effectiveness of Duolingo as a vocabulary learning tool.

The results of earlier studies are supported by this one. For instance, Duolingo greatly enhanced EFL students' vocabulary knowledge and raised their level of engagement throughout the learning process, according to Anggraeni & Degeng [23]. In a similar vein, Irawan, Wilson, and Sutrisno [24] confirmed that Duolingo may be used with conventional teaching techniques and has a favorable impact on vocabulary acquisition. Ajisoko [25] also showed that Duolingo works well as a learning tool since its gamification strategy may increase students' motivation. Explaining the Results: Why Duolingo Was Effective The observed significant improvement can be attributed to several pedagogical and psychological factors inherent in Duolingo's design, aligning with established theories of language acquisition and motivation:

1. Gamification and Motivation

Gamification and Motivation: Points, levels, streaks, and instant feedback are all hallmarks of Duolingo's gamified strategy, which significantly increased student motivation and engagement. This is consistent with Self-Determination Theory (SDT), which holds that when people's demands for autonomy, competence, and relatedness are satisfied, they become more motivated. Although it isn't specifically addressed in this study, Duolingo's competitive leaderboards can indirectly promote relatedness. It also promotes competence through attainable challenges and instantaneous corrective feedback, and it gives users a sense of autonomy by letting them set daily goals. The "Duo" mascot and celebratory animations for correct answers also contribute to a positive affective filter, as described by Krashen's Affective Filter Hypothesis, making learners more receptive to input. This gamified environment successfully captured students' attention and motivated them to participate actively in their learning, moving beyond traditional rote memorization.

2. Interactive and Varied Practice

The interactive activities offer a whole language learning experience and include speaking, listening, reading, and writing assignments. Compared to single-mode learning, this multi-modal technique more successfully reinforces total vocabulary development. For example, a word's brain connections are strengthened when it is encountered in several settings (e.g.,

seeing, hearing, or typing), which improves retention. This is consistent with the vocabulary teaching tenets of Thornbury (2002), which place a strong emphasis on the value of meeting words repeatedly in a variety of settings and participating in meaningful processing.

3. Accessibility and Flexibility

Learning outside of the classroom is made possible with Duolingo, an easily navigable smartphone application. Because of this flexibility, students may reinforce what they learnt throughout the two treatment sessions by practicing vocabulary on their own. Duolingo provides a convenient and entertaining platform for junior high school pupils in Mojokerto, where access to a variety of English learning tools may be restricted. Particularly in situations when English learning materials are few or uninteresting, this accessibility can fill in the gaps in traditional classroom education.

4. Relation to Previous Research and Local Context

The findings of this study are consistent with previous research on the effectiveness of technology-based language learning tools. For instance, Anggraeni & Degeng (2024) found that Duolingo greatly enhanced EFL students' vocabulary knowledge and raised their level of engagement. Similarly, Irawan, Wilson, and Sutrisno (2020) confirmed Duolingo's positive impact on vocabulary acquisition when used with conventional teaching techniques. Ajisoko (2020) also highlighted Duolingo's effectiveness due to its gamification strategy in increasing student motivation.

The findings of this study are consistent with previous research on the effectiveness of technology-based language learning tools. For instance, [26] In this article, the vocabulary is general in nature, but the sample is not specified and it is also not clearly explained whether the statistical method used is the same or not but, while [25] also the population level used is elementary school. This study provides further support that Duolingo can be a valuable supplement to traditional classroom instruction, offering an effective alternative medium for vocabulary learning.

Therefore, the results of this study not only empirically answer the research question but also reinforce the evidence that Duolingo can be used as an effective alternative medium for learning English vocabulary, particularly at the junior high school level. Furthermore, these results also offer a recommendation that technology-based learning applications like Duolingo should be more widely utilized by teachers in order to improve student learning outcomes, especially in the area of vocabulary acquisition.

Conclusion

This study demonstrated that integrating Duolingo into the curriculum significantly enhanced vocabulary mastery among seventh-grade students at SMP Negeri in Mojokerto. The findings revealed a statistically significant improvement in students' vocabulary performance from pre-test to post-test, confirming Duolingo's effectiveness as a tool for supporting vocabulary acquisition in a junior high school setting. This success can be attributed to Duolingo's gamified, interactive, and accessible design, which fostered student engagement and motivation, aligning with established theories of language learning and motivation. While the study's generalizability is limited by its short duration, small sample size, and focus on a single vocabulary topic, it provides compelling evidence for the value of mobile-assisted language learning. Future research should explore the long-term effects of Duolingo, its application to broader vocabulary themes, comparisons with other digital platforms, and its efficacy across diverse educational levels and contexts to further inform curriculum development and the effective integration of educational technology.

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