

## The Effect of the Duolingo App to Improve Vocabulary Mastery Among Gen-Z In an English Course Program

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### ABSTRACT

This study aims to examine the effect of Duolingo on improving vocabulary mastery among Generation Z students in an English course program. This study employed an experimental design with a one-group pre-test and post-test to investigate the effectiveness of using the Duolingo application in enhancing vocabulary learning. Thirty-nine elementary school students aged 7–12 participated in the program, where Duolingo was integrated into classroom activities for five months. Data were collected through vocabulary tests, observations, and interviews. The results revealed a significant improvement in students' vocabulary mastery, with the mean score increasing from 54.10 in the pre-test to 85.77 in the post-test. Statistical analysis using a paired t-test confirmed a highly significant difference ( $t = 10.64$ ,  $p < 0.001$ ), indicating that the Duolingo application effectively enhanced vocabulary acquisition. In addition, qualitative findings showed that students responded positively to using Duolingo, reporting increased motivation and engagement during learning. These findings suggest that mobile-assisted language learning (MALL) tools such as Duolingo can be effective instructional media for young learners, particularly in non-formal educational settings. The study contributes to technology-based pedagogy by highlighting the potential of gamified applications to foster vocabulary mastery and learner motivation.

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## 1. INTRODUCTION

Advances in digital technology, such as smartphones and iPad, have significantly impacted education, including English language learning in Second and Foreign languages [1]. Along with this development, one innovation that has emerged is mobile-assisted language learning (MALL), which allows for flexible, app-based learning and independent learning. Duolingo claimed 200 million active users [2], [3]. This app is perceived as one of the language learning platforms that integrates learning with a gamification approach [4],

[5]. Features such as a points system, interactive exercises, instant feedback, and learning progress graphics make this application relevant for today's digital generation [6]. In Indonesia, the trend of digitization of education has been getting stronger since the pandemic, even applied to the primary school level, both in formal schools and non-formal course programs [7]. Therefore, it becomes important to examine how integrating mobile applications like Duolingo can respond to young learners' growing digital learning needs.

On the contrary, English language learning, particularly vocabulary mastery in elementary school students aged 7–12, still faces various challenges. One major problem is using conventional, less contextual learning methods, such as memorization techniques, that are not enjoyable. These methods quickly cause students to become bored and have difficulty remembering and applying the vocabulary they have learned [8]. Initial observations conducted by the researcher as a tutor at an English language course institution showed that students exhibited greater enthusiasm and better vocabulary retention when the learning process was supported by digital media such as the Duolingo app. This contrast between traditional methods and digital-supported learning highlights the urgency of exploring technology-based interventions to overcome persistent obstacles in vocabulary acquisition.

Several previous studies have demonstrated that Duolingo can improve students' vocabulary mastery and learning motivation [9], [10], showing that using the Duolingo app significantly helps students expand their English vocabulary. Similarly, research by Mulyani and Suryadi [11] found that high school students experienced increased vocabulary comprehension while using Duolingo during online learning. Other research emphasizes that students positively perceive Duolingo in language learning because the app is engaging, easy to use, and provides appropriate learning challenges [12]. However, most of these studies have focused on secondary school students or adults, and few have examined the effectiveness of Duolingo use among elementary school students in non-formal course programs [13], [14]. Thus, there is a clear research gap concerning the impact of Duolingo on younger learners in informal or supplementary educational contexts, which this study aims to address.

Thus, a research need that needs to be addressed is the lack of empirical studies on how the Duolingo app can be systematically utilized in vocabulary learning among students aged 7–12 outside formal school settings. This study offers novelty by integrating the Duolingo app into English language courses, using interactive methods based on LCD projection, group exercises, and direct practice under tutor guidance. The novelty of this approach lies in adapting gamified learning not only as an independent practice but also as a collaborative classroom activity under teacher supervision, which has rarely been documented in previous literature.

The current study examines the effect of Duolingo through mobile devices [15]. This study aims to determine the effect of using the Duolingo application on improving English vocabulary mastery in elementary school students in an English course program. This research is also expected to contribute to technology-based language teaching practices and provide an innovative alternative for teaching English vocabulary to elementary school-aged children [16]. Due to the limited number of empirical studies investigating the effects of Duolingo, the present study addresses the following research questions:

1. How effective is Duolingo in enhancing English vocabulary acquisition among primary school students enrolled in an English course?
2. What are primary school students' experiences with using Duolingo for vocabulary learning?

By answering these questions, the study not only evaluates learning outcomes but also provides insights into students' perceptions, thereby offering a more comprehensive understanding of the pedagogical value of Duolingo in early language education.

## 2. METHOD

This study uses an experimental design to examine the effect of using the Duolingo app on improving English vocabulary mastery in elementary school students [9]. The experimental method was chosen because it allows for the control of variables and enables researchers to determine the causal relationship between the independent variable (Duolingo usage) and the dependent variable (vocabulary mastery). Comparing pre-test and post-test results enables a precise analysis of the impact of Duolingo use on vocabulary mastery improvement. Such a design is widely recognized in educational research as one of the most effective ways to establish whether an intervention directly influences learning outcomes.

This study uses a quantitative approach because it allows for systematic and reliable measurement. This study can use pre-test and post-test assessments to measure significant differences in students' vocabulary mastery before and after the intervention. This approach also provides data that can be statistically analyzed to determine how much the Duolingo app effectively improves students' vocabulary mastery. Using a quantitative framework also strengthens the objectivity of findings, as it minimizes bias and emphasizes measurable improvements in student performance.

### 2.1 Research Context

This research was conducted at the English Course, which integrated technology into its learning process. The institution implements a blended learning approach by combining conventional teaching methods and digital media, specifically the Duolingo app. Learning activities take place in classrooms equipped with LCD projectors and internet access. Students use mobile devices to access the Duolingo app directly under the guidance of tutors. Learning sessions are held twice a week, each lasting approximately 120 minutes. This setting reflects an authentic non-formal educational environment, making the findings relevant to real-world classroom practices beyond strictly controlled laboratory conditions.

### 2.2 Data Collection Techniques

Data collection was conducted between February and June 2025, with the primary data collection technique being a pre-test and post-test to measure vocabulary mastery. The vocabulary test, consisting of 25 multiple-choice questions, was administered to students before intervention (pre-test) and after intervention (post-test) to measure improved vocabulary mastery. This procedure ensured that baseline vocabulary levels were recorded and provided a valid basis for comparison after the intervention period.

In addition to vocabulary tests, quantitative data were collected through observations and interviews. These techniques aimed to explore students' experiences using the Duolingo app and their perceptions of its effectiveness in improving vocabulary retention. Observations were conducted during learning sessions, while interviews were conducted at the end of the study to gather student feedback. The combination of quantitative scores and qualitative insights allowed for a more comprehensive understanding of the outcomes and the processes involved in learning.

- Your pre-test and post-test: A vocabulary mastery test of 25 multiple-choice questions was given before and after treatment to measure improved vocabulary mastery. This instrument was the primary tool for tracking students' vocabulary development throughout the study.

### 2.3 Data Analysis Techniques

The data analysis for this study was performed using SPSS to evaluate differences between pre-test and post-test scores and to explore the relationship between the two measurements. The process began with a one-way analysis of variance (ANOVA) in a within-subjects design to ensure that any observed difference between the two time points was statistically significant.

Quantitative: The pre-test and post-test results were analyzed using descriptive statistics (mean, percentage of improvement) and a paired t-test to see the significance of improving vocabulary mastery.

## 3. RESULTS AND DISCUSSION

The study was conducted on 39 students who participated in English vocabulary learning using the Duolingo application. The pre-test and post-test results showed an improvement in all participants' scores. A summary of the descriptive statistics is presented in Table 1.

Table 1. Descriptive Statistics of Pre-test and Post-test Scores

Statistic	Pre-test	Post-test
Number of samples	39	39
Mean	54.10	85.77
Standard Deviation	17.77	12.59
Minimum Score	20	50
Maximum Score	90	100

The average score increased from 54.10 in the pre-test to 85.77 in the post-test, with an average improvement of 31.67 points. All students (100%) showed improvement in their scores.

### 3.1 Score Improvement Visualization

The comparison between pre-test and post-test scores is illustrated in Figure 1. Students who initially scored lower in the pre-test experienced significant improvement in the post-test.

A paired t-test was conducted between the pre-test and post-test scores to ensure that the observed differences were statistically significant.

- **t-value** = 10.64
- **p-value** = 0.000 ( $p < 0.05$ )

These results indicate a highly significant difference between pre-test and post-test scores. Therefore, the Duolingo application was proven effective in enhancing English vocabulary mastery among elementary school students.

### 3.2 Statistical Test (Paired t-test)

A paired t-test was conducted to examine whether the differences in scores between the pre-test and post-test were statistically significant. The results revealed a t-value of 10.64 with a p-value of 0.000, far below the significance threshold of 0.05. This indicates a significant difference between the students' vocabulary mastery before and after the intervention. Therefore, it can be concluded that the Duolingo application substantially improved students' English vocabulary mastery.

### 3.3 Interpretation

The findings further show that students with lower initial scores (20–45) benefited the most, achieving average improvements of more than 40 points, while students with higher initial scores ( $\geq 75$ ) also improved, though to a lesser degree. This suggests that Duolingo is effective across different levels of language ability, providing significant support to beginners while offering benefits to more advanced learners. The interactive and gamified features of the application appear to play a role in enhancing motivation and engagement, leading to consistent improvements in vocabulary acquisition among all participants.

### 3.4 Research Procedure

The research procedure was carried out in three interconnected stages. The first stage was the pre-test, in which the researcher administered a vocabulary test consisting of 25 multiple-choice items to all participants before the intervention began. This stage aimed to obtain baseline data on students' vocabulary mastery as a reference point for later comparison. The second stage was the learning phase, integrating the Duolingo application, conducted over five months with two weekly meetings, each lasting 120 minutes. In this phase, students engaged with Duolingo directly through mobile devices under tutor supervision, supported by LCD projection, group exercises, and individual practice. The researcher observed and documented student engagement during the sessions to complement the quantitative results with qualitative insights. The third stage was the post-test, where the same vocabulary test used in the pre-test was administered again to measure improvements in vocabulary mastery after the intervention. The results from these three stages were then comparatively analyzed to determine the effectiveness of the Duolingo application in enhancing students' vocabulary acquisition.



Figure 1. Pre-test



Figure 2. Classes



Figure 3. Post-test

### 3.5 Data Validity

To ensure the validity of qualitative data, researchers apply several strategies, including triangulation, which uses various data sources (observations, questionnaires, interviews) to confirm the findings. Member checking: Several participants were asked to verify the accuracy of the interpretation of the interview results. Peer debriefing: The research process and interpretation of results are discussed with peer tutors to obtain input and validation. Audit trail: All research procedures, data collection instruments, and analysis steps are documented in detail to maintain transparency and replication of the research.

### 3.6 Discussion

In response to the first research question, *How effective is Duolingo in enhancing English vocabulary acquisition among primary school students enrolled in an English course?*. The results of this study confirm that the use of the Duolingo application can significantly improve elementary school students' vocabulary mastery. The substantial gains observed in the post-test scores are consistent with previous studies [9], which reported that mobile-assisted language learning (MALL) applications enhance vocabulary acquisition through interactive and gamified learning environments [17]. The statistical significance of the findings ( $t = 10.64, p < 0.001$ ) reinforces the view that digital learning platforms are not merely supplementary tools but can serve as powerful drivers of language learning outcomes. This indicates that Duolingo has the potential to function not only as an additional resource but also as a central element of vocabulary instruction in non-formal educational programs.

A noteworthy finding of this study is that Duolingo was effective across all student proficiency levels. Learners with lower baseline vocabulary demonstrated the greatest gains, which aligns with the findings of Carlo [18], who noted that mobile learning particularly benefits learners at the beginner level by offering repeated, scaffolded exposure to target vocabulary. At the same time, higher-achieving students also showed measurable improvements, suggesting that the adaptive structure and personalized feedback embedded in the Duolingo platform can sustain engagement even among more advanced learners [19]. This dual impact on both beginners and more proficient learners highlights the inclusive nature of gamified applications, which can cater to varied levels of ability within the same learning environment.

The gamification features of Duolingo, such as points, levels, and immediate corrective feedback, play a central role in enhancing motivation and learner persistence. This supports the motivational theories in second language acquisition, particularly the L2 motivational self-system concept, which highlights the importance of engaging learners in self-directed and enjoyable tasks [20]. By integrating these features, Duolingo may foster intrinsic and extrinsic motivation, creating an environment where students are more likely to sustain vocabulary learning over time. Consequently, the motivational aspects of the platform should be considered not as incidental benefits but as key mechanisms driving long-term learning success.

From a pedagogical perspective, these findings suggest important implications for formal and non-formal education contexts [21]. Language teachers can integrate Duolingo as a complementary tool to traditional classroom instruction, enriching students' exposure to vocabulary beyond the limited hours of formal study [22]. This blended approach aligns with contemporary trends in digital education, where technology is leveraged to provide personalized and continuous learning experiences [23]. Such integration could also help address disparities in access to quality English instruction, particularly in regions where resources for language education remain limited.

Responding to the second research question, *what are primary school students' experiences using Duolingo for vocabulary learning?*

In summary, the discussion highlights that the Duolingo application, as a form of mobile-assisted language learning, effectively improves vocabulary mastery, motivates learners, and supports diverse proficiency levels. Its integration into language education holds promise for fostering more engaging, learner-centered, and technologically enriched classroom practices [24]. The findings confirm that Duolingo contributes to cognitive outcomes, vocabulary gains, and affective outcomes, such as motivation and engagement, offering a comprehensive model for technology-enhanced language learning.

## 4. CONCLUSION AND IMPLICATION

### 4.1 Conclusion

In summary, this study provides compelling evidence that integrating the Duolingo application into English language learning significantly enhances students' vocabulary mastery at the elementary school level [9]. The findings revealed a substantial improvement in students' performance, with mean scores increasing from 54.10 in the pre-test to 85.77 in the post-test, representing an average gain of 31.67 points. Statistical analysis using a paired t-test confirmed that this improvement was highly significant ( $t = 10.64, p < 0.001$ ), thereby validating the effectiveness of Duolingo as an instructional tool. When systematically applied, these results confirm that mobile-assisted language learning can yield measurable benefits for young learners in structured non-formal programs.

Notably, the results demonstrate that Duolingo benefits learners across different proficiency levels. Students with lower initial scores experienced the most substantial gains, while those with higher baseline proficiency showed meaningful improvement. This suggests that the application is versatile in addressing diverse learner needs [25]. The gamification and interactive features embedded in the platform likely contributed to heightened motivation, sustained engagement, and ultimately, better vocabulary acquisition outcomes [26]. This versatility indicates that Duolingo can be adapted for heterogeneous classrooms, supporting both struggling learners and advanced students within the same instructional framework.

Although providing insights into English language teaching to young learners in diverse classes, the study also acknowledges certain limitations. The research focused on short-term vocabulary gains and did not examine long-term retention or the transferability of learned vocabulary into productive skills such as speaking and writing. Future research should therefore investigate the durability of vocabulary retention over extended periods and explore how mobile applications can be systematically combined with communicative teaching strategies to maximize overall language competence. Acknowledging these limitations ensures transparency while opening new directions for subsequent studies in technology-enhanced pedagogy.

Overall, the findings underscore the pedagogical potential of mobile-assisted language learning (MALL) applications such as Duolingo in formal and non-formal educational contexts [27]. Beyond its positive impact on vocabulary mastery, this study highlights the importance of integrating digital tools into language education to create more engaging, learner-centered environments. Future research is encouraged to explore the long-

term retention of vocabulary gained through such applications and their effectiveness when combined with other instructional strategies.

#### 4.2 Implication

This study offers important implications for English language education, especially within non-formal settings. Theoretically, the findings reinforce the growing scholarship on Mobile-Assisted Language Learning (MALL), showing that gamified applications like Duolingo can meaningfully support vocabulary growth among Generation Z learners. Features such as points, instant feedback, and progress tracking are consistent with motivational frameworks, including the L2 Motivational Self-System, and demonstrate how digital engagement can foster more effective vocabulary learning. Therefore, this research strengthens the theoretical foundation that positions gamified digital tools as supplementary resources and integral components of modern language pedagogy.

From a practical perspective, the results indicate that Duolingo can be used as a complementary tool to conventional teaching, extending vocabulary practice beyond the classroom and keeping learners engaged. For educators and institutions, these findings highlight the need to invest in digital-based pedagogy through proper infrastructure and teacher preparation. Future studies should investigate whether the observed vocabulary gains can be sustained over time, applied to productive skills such as speaking and writing, and compared with outcomes from other mobile learning platforms across broader and more varied learner groups. Such practical implications emphasize that educational stakeholders must adopt technological innovations and evaluate their long-term impact, ensuring that the integration of digital applications leads to sustainable and equitable improvements in language learning outcomes.

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