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The Effect of Duolingo Usage Duration on Vocabulary Size: A Quasi-Experimental Study at Senior High School *NU* Palangka Raya

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ABSTRACT

Vocabulary size is a key component of English as a Foreign Language (EFL) learners' proficiency; however, many students still struggle to develop sufficient vocabulary, especially in contexts with limited exposure to English. Although previous studies have highlighted the benefits of Mobile-Assisted Language Learning (MALL), the role of structured session duration in vocabulary development remains underexplored. This study examines the effect of fixed Duolingo usage duration on the vocabulary size of twelfth-grade students at SMA *NU* Palangka Raya. A quasi-experimental design was applied, involving an experimental group and a control group, both receiving pre-tests and post-tests using a standardized vocabulary test. The experimental group completed four 30-mi*NU*te Duolingo sessions, while the control group engaged in conventional instruction, including flashcard memorization and fill-in-the-gap exercises, within the same time allocation. Results indicated improvement in both groups; however, the experimental group achieved significantly higher gains, with a post-test mean score of 66.83 compared to 50.73 in the control group. Statistical analysis revealed a significant difference ($t(21) = -5.637$, $p < .001$), demonstrating the effectiveness of structured Duolingo usage. These findings suggest that fixed, time-structured learning supported by adaptive digital features can enhance vocabulary development more effectively than conventional methods. The study underscores the potential of integrating structured mobile learning into classroom practice, although its small sample size and short duration limit generalizability. Further research is needed to examine long-term effects and varied duration designs.

INTRODUCTION

Vocabulary size constitutes a fundamental component of language proficiency in English as a Foreign Language (EFL), as it directly influences learners' ability to comprehend texts, express ideas, and participate in academic communication (Alsahafi, 2023; Hakami, 2025; Lei et al., 2022; Sun et al., 2023; Taye & Teshome, 2025). In senior high school contexts, students are required to engage with increasingly complex texts and instructional materials in English, particularly in preparation for examinations and further academic study. Research on lexical coverage indicates that knowledge of approximately 1,000–3,000 words families is necessary for adequate comprehension of general English texts (Nation, 2001; Schmitt, 2020). However, many Indonesian EFL learners continue to experience limitations in vocabulary knowledge within this essential range. This condition is closely related to the limited exposure to English beyond classroom settings, where learning is often confined to scheduled instructional time. As a result, insufficient vocabulary knowledge frequently disrupts meaning construction and reduces overall learning efficiency (Akyildiz, 2025; Cabrera-Solano, 2022; Doshi et al., 2023; Liu, 2024).

A substantial body of research has emphasized the central role of vocabulary in supporting overall language development (Yan et al., 2024; Zhao, 2025). Limited vocabulary knowledge not only constrains communication but also restricts the development of other language skills, including reading, writing, listening, and speaking (Ali, 2021; Polyzi & Moussiades, 2023). Although learners employ a variety of vocabulary learning strategies, their effectiveness is closely influenced by the nature of instructional design and the level of learner engagement (Zuhairi & Mistar, 2023). In many Indonesian classrooms, vocabulary instruction remains largely teacher-directed, relying on techniques such as flashcard memorization and fill-in-the-gap exercises. While these approaches support repeated exposure, they often provide uniform input, limited feedback, and are frequently implemented as massed practice within a single session. Such conditions may support short-term recognition but are less effective in promoting long-term retention, particularly when learning is not distributed across time.

These limitations have encouraged the exploration of alternative approaches that can combine structured exposure with sustained learner engagement (Li & Li, 2022; Peng, 2024; Sharma et al., 2024; Verawati & Nisrina, 2025; Yaseen et al., 2025). One approach that has gained increasing attention is Mobile-Assisted Language Learning (MALL), which integrates mobile technologies into language instruction. Applications such as Duolingo offer structured learning environments characterized by repetition, immediate feedback, gamified elements, and adaptive progression. These features enable learners to interact with vocabulary in more dynamic and responsive ways compared to conventional classroom techniques, while also allowing greater flexibility in how learning time is organized.

From a theoretical perspective, vocabulary acquisition can be understood through several complementary frameworks. Behaviorist principles emphasize the role of repetition and reinforcement in strengthening memory associations, while constructivist perspectives highlight the importance of active engagement and meaningful interaction with learning materials. In addition, the time-on-task principle (Carroll, 1963) suggests that learning outcomes are closely related to the amount of time learners spend actively engaged in tasks. This perspective is further supported by the concept of distributed practice, which demonstrates that learning distributed over time leads to more durable retention than massed practice (Cepeda et al., 2006). Within MALL environments, these principles converge, as digital platforms enable controlled exposure, adaptive feedback, and structured learning sequences. However, while these theoretical perspectives explain why such environments can be effective, they do not yet clarify how learning time should be optimally structured within those environments.

Empirical studies have reported positive relationships between MALL usage and vocabulary growth. For instance, Loewen et al. (2020) identified measurable vocabulary gains associated with engagement in Duolingo, while Sudina and Plonsky (2024) reported a moderate overall effect of MALL interventions on vocabulary acquisition. Taken together, these findings suggest that digital learning environments can support vocabulary development when learners engage with them consistently. Nevertheless, most studies conceptualize learning exposure in terms of total usage time or frequency, without distinguishing how learning is distributed across sessions. Consequently, it remains unclear whether specific temporal structures, such as fixed session duration, independently contribute to vocabulary development.

The novelty of this research lies in its focus on isolating session duration as a controlled variable within a quasi-experimental design, rather than examining digital learning in general terms. Unlike previous studies that examined total usage time or frequency of use, this study specifically investigates whether four fixed 30-mi*NU*te Duolingo sessions produce measurable vocabulary gains compared to conventional instruction with equivalent time

allocation. This approach allows for a clearer understanding of how temporally structured engagement may contribute to vocabulary development within a specific lexical range. Additionally, this study employs the standardized Vocabulary Size Test developed by Nation and Beglar (2007), ensuring measurement validity and enabling comparison with other research findings.

This issue becomes particularly relevant in instructional contexts where learning time is limited and must be used efficiently, such as in Indonesian secondary schools. While digital learning tools are increasingly adopted, there is still limited empirical evidence regarding how session duration influences vocabulary outcomes under controlled conditions. In addition, the predominance of descriptive and qualitative approaches in previous research makes it difficult to determine causal relationships between structured learning time and measurable vocabulary gains.

Building on these considerations, the present study examines the role of session duration in MALL-based vocabulary learning by focusing on structured Duolingo usage. Specifically, this study investigates whether four sessions of 30-mi*NU*te Duolingo use significantly influence the vocabulary size of twelfth-grade students at SMA *NU* Palangka Raya. A quasi-experimental design with pre-test and post-test measures, using the Vocabulary Size Test developed by Nation and Beglar (2007), is employed to compare outcomes between students who engage in structured Duolingo sessions and those who receive conventional vocabulary instruction.

By isolating session duration as a controlled variable, this study seeks to clarify how learning time can be organized to support vocabulary development more effectively. Rather than examining digital learning in general terms, the analysis focuses on how temporally structured engagement may contribute to measurable gains within a specific lexical range. In doing so, the study not only extends existing discussions on time-on-task and distributed practice, but also provides practical insight into how mobile learning can be integrated into classroom instruction in ways that are both manageable and pedagogically meaningful.

METHOD

This study adopted a quantitative approach to examine changes in students' vocabulary size under controlled instructional conditions. A quasi-experimental design with a pre-test and post-test structure was employed to capture measurable differences in learning outcomes between groups over time. Such a design allows for comparison while maintaining the natural classroom setting, where random assignment is not feasible. The research was conducted at Senior High School *NU* Palangka Raya during the 2026/2027 academic year. A total of 23 twelfth-grade students participated in the study, selected through purposive sampling based on class grouping. The experimental group consisted of 12 students from Grade XII Science (IPA), while the control group included 11 students from Grade XII Social Studies (IPS). This grouping reflects existing classroom conditions and enables a direct comparison between two instructional approaches within the same institutional context.

To measure students' vocabulary size, a standardized vocabulary test was used. The instrument assesses learners' knowledge of word meaning and recognition within a controlled format and is widely used in EFL research to capture receptive vocabulary development. In this study, the test was administered in both the pre-test and post-test phases to ensure comparability of results across time.

At the initial stage, both groups completed the pre-test to establish baseline vocabulary levels. Following this, the treatment phase was implemented over four scheduled sessions. The experimental group engaged in structured learning using Duolingo, with each session lasting 30 mi*nu*tes, ensuring consistency in time-on-task across all participants. The application provided repeated exposure, immediate feedback, and adaptive progression

throughout the sessions. In contrast, the control group received conventional vocabulary instruction, consisting of flashcard-based memorization and fill-in-the-gap exercises conducted within the same time allocation. This parallel structure ensured that differences in outcomes could be more directly associated with the mode of instruction rather than differences in total learning time. After the completion of the treatment phase, both groups were administered the same test as a post-test to measure any changes in vocabulary size. The use of identical instruments in both testing phases allows for a direct comparison of pre- and post-intervention performance.

The collected data were analyzed using Statistical Package for the Social Sciences (SPSS). The analysis included descriptive statistics to summarize students' performance and inferential statistics to examine differences between groups. In line with common practice in quasi-experimental research, statistical procedures were applied to evaluate whether observed differences in vocabulary gains were significant. The use of SPSS facilitates systematic data processing and supports the verification of statistical assumptions, thereby ensuring the reliability and transparency of the findings (Iskandar et al., 2025).

RESULTS AND DISCUSSION

The aim of this study was to examine whether the duration of Duolingo usage could significantly improve students' vocabulary size compared to conventional instruction. The findings indicate that both groups experienced improvement from pre-test to post-test; however, the experimental group demonstrated a more substantial increase.

Descriptive Statistics

Table 1. Descriptive Statistics for Control Group (12 IPS)

Statistics	Pre-Test (Control)	Post-Test (Control)
N Valid	11	11
Missing	0	0
Mean	48.36	50.73
Std. Error of Mean	2.184	2.094
Median	48.00	50.00
Std. Deviation	7.243	6.944
Variance	52.455	48.218
Range	24	23
Minimum	37	40
Maximum	61	63

Table 2. Descriptive Statistics for Experimental Group (12 IPA)

Statistics	Pre-Test (Experimental)	Post-Test (Experimental)
N Valid	12	12
Missing	0	0
Mean	48.25	66.83
Std. Error of Mean	2.182	1.949
Median	48.00	67.00
Std. Deviation	7.557	6.753
Variance	57.114	45.606
Range	24	22
Minimum	36	55
Maximum	60	77

The descriptive statistics reveal several important findings regarding students' vocabulary development. First, both the control and experimental groups showed improvement from pre-test to post-test, indicating that learning occurred in both instructional conditions. The control group's mean score increased from 48.36 to 50.73, representing a modest gain of 2.37 points (approximately 4.9%). In contrast, the experimental group demonstrated a substantially higher improvement, with the mean score increasing from 48.25 to 66.83, reflecting a gain of 18.58 points (approximately 38.5%). This indicates that students who engaged in structured Duolingo sessions achieved significantly greater vocabulary growth compared to those receiving conventional instruction.

Second, the standard deviation decreased slightly in both groups from pre-test to post-test (from 7.243 to 6.944 in the control group and from 7.557 to 6.753 in the experimental group). This suggests that students' vocabulary performance became more homogeneous after the intervention. The reduction in variability was slightly more pronounced in the experimental group, indicating that the Duolingo-based learning may have been more effective in supporting lower-performing students and reducing performance gaps within the group.

Third, the range of scores also decreased in both groups. In the control group, the range decreased from 24 to 23, while in the experimental group it decreased from 24 to 22. Although the reduction is relatively small, it further supports the observation that students' scores became more consistent after the learning process.

Finally, the minimum score in the experimental group increased significantly from 36 in the pre-test to 55 in the post-test, whereas the control group showed a smaller increase from 37 to 40. This finding indicates that even the lowest-performing students in the experimental group achieved higher improvements compared to their counterparts in the control group. Additionally, the maximum score in the experimental group increased from 60 to 77, which is considerably higher than the control group's post-test maximum of 63. Overall, these findings suggest that while both instructional methods contributed to vocabulary development, the use of Duolingo with structured duration had a more substantial and consistent impact on students' vocabulary size. The greater improvement observed in the experimental group supports the effectiveness of mobile-assisted language learning, particularly when learning time is systematically organized.

Normality Test

Table 3. Shapiro–Wilk Test of Normality

	Shapiro–Wilk Statistic		
	Statistics	**df**	**Sig.**
Pre-Test Control (12 IPS)	0.989	11	0.996
Post-Test Control (12 IPS)	0.986	11	0.989
Pre-Test Experimental (12 IPA)	0.978	12	0.976
Post-Test Experimental (12 IPA)	0.979	12	0.980

The normality test was conducted using the Shapiro–Wilk statistic to determine whether the data were normally distributed. The results indicate that all datasets fulfilled the assumption of normality. Specifically, the pre-test scores of the control group yielded a Shapiro–Wilk value of 0.989 with a significance value of 0.996, while the post-test scores showed a value of 0.986 with a significance of 0.989. Similarly, the experimental group's pre-test scores resulted in a Shapiro–Wilk value of 0.978 ($p = 0.976$), and the post-test scores showed a value of 0.979 ($p = 0.980$). Since all significance values (p-values) are substantially greater than the threshold of 0.05, it can be concluded that all data distributions are normal. This indicates that there is no significant deviation from normality in either group at both

testing stages. The fulfillment of the normality assumption is important, as it allows the researcher to proceed with parametric statistical analyses. Therefore, the use of independent samples t-tests in subsequent analyses is justified and statistically appropriate.

Homogeneity Test

Table 4. Levene's Test of Homogeneity of Variances (Post-Test)

	Levene Statistic	df1	df2	Sig.
Based on Mean	0.000	1	21	0.989

The homogeneity test was conducted using Levene's Test to examine whether the variances of the post-test scores between the control and experimental groups were equal. The result shows that the Levene's statistic value is 0.000 with a significance value (p-value) of 0.989. Since the significance value is greater than 0.05 ($p > 0.05$), it can be concluded that there is no significant difference in variance between the two groups. This finding indicates that the assumption of homogeneity of variances has been satisfied, meaning that the spread of scores in both the control and experimental groups is statistically comparable. The fulfillment of this assumption is important for conducting parametric tests, particularly the independent samples t-test. Therefore, the analysis can proceed using the "Equal variances assumed" row in the independent samples t-test output. Overall, the results confirm that the data meet the required assumptions for parametric statistical analysis, supporting the validity and reliability of the subsequent hypothesis testing.

Independent Samples T-Test (Pre-Test)

Table 5. Independent Samples T-Test Comparing Pre-Test Scores

	Levene's Test				
	(F)	Sig.	t	df	Sig. (2-tailed)
Pre-Test (Equal Variances Assumed)	0.058	0.812	0.037	21	0.971

Not significantly different ($p = 0.971$) → the initial groups are equivalent.

At the beginning of the study, the two groups demonstrated comparable levels of vocabulary size. The experimental group had a mean pre-test score of 48.25, while the control group scored 48.36. This very small difference was not statistically significant, as indicated by the p-value of 0.971, which is far above the significance threshold of 0.05. This finding confirms that both groups started from a similar baseline in terms of vocabulary knowledge. Establishing baseline equivalence is essential in quasi-experimental research, as it ensures that any differences observed in the post-test can be attributed to the treatment rather than pre-existing differences between groups. Furthermore, the non-significant result supports the validity of the sampling method and indicates that the two classes were comparable prior to the intervention. Therefore, the study meets an important assumption for causal interpretation, strengthening the conclusion that subsequent differences are due to the Duolingo treatment rather than initial disparities.

Independent Samples T-Test (Post-Test)

Table 6. Independent Samples T-Test Comparing Post-Test Scores

	Levene's Test				
	F	Sig.	t	df	Sig. (2-tailed)
Post-Test (Equal Variances Assumed)	0.000	0.989	-5.637	21	0.000

Significantly different ($p < .001$) → the experimental group outperformed the control group.

The post-test results reveal a significant difference between the experimental and control groups after the treatment. The independent samples t-test yielded a t-value of -5.637 with 21 degrees of freedom and a p-value of 0.000, which is well below the significance threshold of 0.05. This result provides strong statistical evidence that the use of Duolingo with structured duration had a significant positive effect on students' vocabulary size. The mean post-test score of the experimental group (66.83) was substantially higher than that of the control group (50.73), with a mean difference of 16.11 points.

This substantial difference indicates that students who engaged in Duolingo-based learning achieved significantly better vocabulary outcomes compared to those who received conventional instruction. The negative t-value reflects that the experimental group had higher scores than the control group based on the coding of group variables. In addition, the confidence interval of the mean difference (ranging from -22.05 to -10.16) does not include zero, further confirming that the difference between groups is statistically significant and not due to random variation. Thus, these findings suggest that while both groups experienced some level of improvement, the experimental group demonstrated significantly greater gains. This supports the hypothesis that structured Duolingo usage contributes more effectively to vocabulary development than traditional teaching methods.

Table 7. Post-Test Comparison Between Experimental and Control Groups

Group	N	Mean	Std. Deviation	Std. Error Mean
Experimental Group	12	66.83	6.21	1.79
Control Group	11	50.73	7.35	2.22

The post-test comparison results indicate a clear difference in vocabulary achievement between the experimental and control groups after the treatment was administered. The experimental group, which received instruction using Duolingo with structured duration, achieved a higher mean score (M = 66.83) compared to the control group (M = 50.73).

This difference of approximately 16.10 points reflects a substantial improvement in vocabulary mastery among students exposed to the Duolingo-based learning approach. In contrast, the control group, which received conventional instruction, showed relatively lower performance, suggesting that traditional methods may not be as effective in enhancing vocabulary acquisition within the same time frame.

Moreover, the standard deviation values indicate that both groups had relatively consistent score distributions, although the control group showed slightly higher variability (SD = 7.35) compared to the experimental group (SD = 6.21). This suggests that the learning outcomes in the experimental group were not only higher but also more consistent across students. These descriptive findings are further supported by the results of the independent samples t-test (Table 6), which confirmed that the difference between the two groups is statistically significant ($p < 0.05$). Therefore, it can be concluded that the use of Duolingo with structured duration has a significant positive effect on students' vocabulary size.

CONCLUSION

This study investigated how structured Duolingo sessions influence the vocabulary size of twelfth-grade EFL students at Senior High School *NU* Palangka Raya. The findings indicate that both groups demonstrated improvement over time; however, students who engaged in four 30-mi*NU*te Duolingo sessions showed greater gains in vocabulary size compared to those who received conventional instruction. The comparable results at the pre-test stage suggest that both groups started from a similar level, while the differences observed in the post-test point to the role of the instructional treatment. These results highlight the importance of how learning time is organized rather than simply how much time is spent. When exposure is

structured into consistent sessions supported by immediate feedback and repeated interaction, learners appear to develop vocabulary more effectively than through conventional practices that rely primarily on single-session repetition. In this context, the use of Duolingo demonstrates how digitally mediated learning can support more sustained engagement and facilitate vocabulary development within a limited instructional timeframe. The findings also suggest that integrating structured mobile learning into classroom practice can provide a practical alternative to traditional vocabulary instruction, particularly in contexts where exposure to English is limited. By combining controlled time-on-task with adaptive learning features, such approaches offer a more flexible yet systematic way to support vocabulary growth. At the same time, several limitations should be considered. The relatively small sample size and the short duration of the intervention limit the extent to which the findings can be generalized. In addition, the study focuses on immediate gains in vocabulary size, without examining long-term retention or transfer to other language skills. Further research could extend this work by involving larger and more diverse participant groups, exploring different session durations or frequencies, and examining the long-term effects of structured mobile learning on vocabulary retention and broader language development.

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