Using Duolingo to Support Vocabulary Learning Among Year 5 ESL Pupils in a Primary School in Kedah, Malaysia

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ABSTRACT

Vocabulary plays an important role in helping primary ESL pupils understand texts and express ideas more confidently. However, traditional vocabulary instruction often relies on rote memorisation and teacher-centred practices, which may limit opportunities for sustained vocabulary learning, particularly in multilingual contexts with limited English exposure. This study examined the use of Duolingo as a mobile-assisted language learning (MALL) tool to support vocabulary learning among Year 5 ESL pupils in a primary school in Kedah, Malaysia. A quantitative one-group pre-experimental design was employed with one intact class of 30 Year 5 pupils who participated in a four-week Duolingo intervention. Pupils' vocabulary scores were obtained from a pre-test, an immediate post-test, and a delayed post-test administered two weeks after the intervention. Data were analysed using repeated measures ANOVA with Greenhouse–Geisser correction. The results revealed statistically significant differences in vocabulary scores across the three testing occasions. Pairwise comparisons showed significant differences between all testing points, with delayed post-test scores significantly higher than both pre-test and immediate post-test scores. Although pupils demonstrated higher vocabulary scores following the intervention, the delayed increase should be interpreted cautiously because this atypical pattern may reflect influences beyond the intervention itself. The study highlights the pedagogical potential of gamified mobile-assisted learning as a supplementary approach to vocabulary instruction, particularly when it is structured, teacher-guided, and integrated with classroom vocabulary practice in primary ESL settings.

Keywords:
Duolingo; Mobile-assisted language learning; Vocabulary learning; Gamified vocabulary practice; Primary ESL pupils

Introduction

Vocabulary knowledge is the foundation of all four language skills: listening, speaking, reading, and writing, and is therefore central to successful English instruction for learners of English as a Second Language (ESL) (Nation, 2013; Teng, 2023; Webb & Nation, 2017). In primary classrooms, vocabulary instruction often relies on teacher-centred methods such as rote memorisation and repetitive drilling. Although these methods may help pupils learn basic word forms, they may also result in poor long-term recall when words are taught without meaningful context (Lee, 2023; Nation, 2013; Webb & Nation, 2017).

Strong vocabulary knowledge enables pupils to construct sentences, comprehend texts, express ideas in writing, and communicate more confidently. For Malaysian primary pupils, mastery of core vocabulary is also important because it supports CEFR-aligned learning objectives and classroom-based assessment (Kementerian Pendidikan Malaysia, 2020). Lasting retention is important because short-term memorisation may not always lead to meaningful language use or preparation for higher levels of learning.

Malaysian primary ESL pupils face several interrelated challenges. One challenge is the multilingual home environment, where Malay or other mother tongues may be more dominant than English. This can reduce pupils' exposure to English outside school and weaken the transfer of classroom learning to real communication (Chai et al., 2020; Manap et al., 2025; Ni & Yunus, 2020). In addition, instructional practices that emphasise rote learning with limited contextual use may contribute to rapid forgetting (Ganesan et al., 2025). These factors create a gap between the words introduced in class and the vocabulary that pupils can reliably recall and use.

Mobile-assisted language learning (MALL) and gamified applications such as Duolingo may offer an alternative to traditional vocabulary instruction. MALL provides learners with flexible access and repeated language practice

through mobile devices and applications (Burston, 2015; Pang & Aziz, 2021). For Malaysian primary ESL pupils, Duolingo may function as a supplementary tool to classroom instruction by making vocabulary practice more interactive, accessible, and manageable.

Although studies have reported the benefits of Duolingo and other mobile-assisted tools for language learning, many have focused on older learners, such as secondary school students, vocational learners, university students, or adult learners (Hia et al., 2024; Loewen et al., 2019; Pramesti et al., 2025; Rahman et al., 2025; Zeng & Fisher, 2024; Zunaya & Suhartono, 2024). Previous studies have generally reported positive outcomes associated with Duolingo use, including improvements in vocabulary learning and vocabulary performance, as well as increased motivation and engagement. However, these findings may not fully explain how Duolingo works with primary pupils because young learners may require clearer instructions, teacher demonstration, and classroom support when using digital tools. Evidence on the use of Duolingo for vocabulary learning among primary ESL pupils, particularly in Malaysian multilingual classrooms, also remains limited.

Therefore, this study examines the use of Duolingo to support vocabulary learning among Year 5 ESL pupils in a Malaysian primary school. Specifically, the study investigates whether pupils' vocabulary scores improved following a four-week Duolingo-supported vocabulary intervention and how their scores differed between the immediate post-test and the delayed post-test conducted two weeks after the intervention.

Research Questions

Based on this purpose, the study was guided by the following research questions:

1. What is the difference in Year 5 ESL pupils' vocabulary scores before and after the four-week Duolingo-supported vocabulary intervention?
2. How do Year 5 ESL pupils' vocabulary scores differ between the immediate post-test and the delayed post-test?

Literature Review

Vocabulary Learning among Primary ESL Pupils

Vocabulary learning among primary ESL pupils requires repeated and meaningful exposure to new words to support their understanding and use over time. For young ESL learners, repeated practice is particularly important in strengthening vocabulary knowledge and providing opportunities to encounter and use newly learned words in different contexts.

Vocabulary learning can nevertheless be challenging for primary ESL pupils. Traditional vocabulary instruction often relies on teacher-centred explanation, rote memorisation, and drilling. Such approaches may help pupils recognise and remember basic word forms for a short period of time (Ganesan et al., 2025). However, vocabulary learned with limited meaningful context may be more difficult to retain and use subsequently. Previous studies have highlighted the importance of contextualised learning, repeated exposure, and meaningful vocabulary practice in supporting vocabulary development over time (Chen et al., 2018; Lee, 2023; Nation, 2013; Teng, 2023; Webb & Nation, 2017).

In multilingual Malaysian contexts, some pupils may also have limited opportunities to use English outside school, particularly when Malay or other home languages are used more frequently in everyday communication (Kashinathan & Aziz, 2021). Consequently, vocabulary introduced during classroom lessons may receive limited reinforcement beyond formal instruction (Chai et al., 2020; Manap et al., 2025; Ni & Yunus, 2020). This highlights the need for vocabulary learning activities that provide repeated practice, meaningful exposure, and accessible opportunities for pupils to engage with new words.

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Mobile-Assisted Language Learning and Duolingo

Mobile-Assisted Language Learning (MALL) refers to the use of mobile devices and applications to support language learning. MALL can provide learners with flexible and repeated practice through short learning activities (Burston, 2015; Pang & Aziz, 2021). This is useful for primary pupils because they may benefit from learning tasks that are simple, manageable, and interactive. MALL also allows learners to receive feedback and practise language items more independently, although young learners still need teacher guidance (Al-Ahdal & Alharbi, 2021; Govindasamy et al., 2019; Pang & Aziz, 2021).

Duolingo is one example of a MALL application that may support vocabulary learning. The application provides gamified features such as points, hearts, streaks, leaderboards, and immediate feedback (Loewen et al., 2019; Sailer & Homner, 2020; Zeng & Fisher, 2024). These features may make vocabulary learning more engaging and encourage pupils to continue practising. Duolingo also presents lessons in short units, which may be suitable for young learners with shorter attention spans. Through repeated exposure and feedback, pupils may have more opportunities to remember and use new vocabulary.

Previous studies have reported that Duolingo and other mobile learning tools can support vocabulary learning, motivation, and learner engagement (Al-Ahdal & Alharbi, 2021; Ali & Ghazali, 2016; Govindasamy et al., 2019; Hia et al., 2024; Loewen et al., 2019; Pang & Aziz, 2021; Pramesti et al., 2025; Zeng & Fisher, 2024). However, many studies have focused on secondary, tertiary, or adult learners. These learners are different from primary pupils because they may have stronger self-regulation, longer attention spans, and more experience using learning applications. Primary pupils may need more structured instructions, teacher demonstration, and classroom support when using digital tools for vocabulary learning.

Theoretical Framing

This study is mainly guided by Mobile-Assisted Language Learning (MALL). MALL supports the use of mobile devices and applications to provide flexible, repeated, and learner-centred language practice (Burston, 2015; Pang & Aziz, 2021). In vocabulary learning, this is relevant because pupils need repeated exposure to words before they can remember and use them confidently. Duolingo reflects several features of MALL through its short lessons, immediate feedback, gamified activities, and learner-paced practice. These features may help make vocabulary learning more manageable and engaging for primary ESL pupils.

Krashen's Input Hypothesis and Affective Filter Hypothesis also help explain the use of Duolingo in this study. According to the Input Hypothesis, learners acquire language when they receive comprehensible input that is slightly above their current level (Krashen, 1982). Duolingo may support this by providing short and scaffolded vocabulary exercises suitable for beginner-level learners. The Affective Filter Hypothesis is also relevant because pupils may learn better when they feel motivated and less anxious. Duolingo's gamified features, such as points, hearts, leaderboards, and immediate feedback, may create a lower-pressure environment for vocabulary practice.

Based on these perspectives, this study examines Duolingo-supported vocabulary learning among Year 5 Malaysian primary ESL pupils. It focuses on changes in pupils' vocabulary scores following a four-week intervention and at a delayed post-test two weeks later. MALL provides the broader framework for understanding Duolingo as a mobile-assisted vocabulary learning tool, while Krashen's hypotheses help explain how scaffolded input and a lower-pressure learning environment may support vocabulary learning among primary ESL pupils.

Methods

Research Design

This study employed a quantitative one-group pre-experimental design to examine the use of Duolingo in supporting vocabulary learning among Year 5 ESL pupils (Creswell & Creswell, 2018). The design involved three measurement points: a pre-test to establish baseline vocabulary scores, an immediate post-test after a four-week Duolingo intervention, and a delayed post-test administered two weeks later to examine pupils' vocabulary scores following the

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intervention. This design was suitable because random assignment was not possible in the school setting, and the study aimed to examine changes in pupils' vocabulary scores over time under natural classroom conditions.

Participants and Setting

The participants consisted of 30 Year 5 ESL pupils from one primary school in Pendang, Kedah, Malaysia. All participants were 11 years old and were from the same Year 5 class. The group consisted of 13 male pupils and 17 female pupils. None of the pupils had prior experience using the Duolingo application before the intervention. An intact class was selected because the study was conducted in a natural school setting where random assignment of individual pupils was neither practical nor permitted. Using an existing class allowed the intervention to be implemented in an authentic classroom context while minimising disruption to the school's regular timetable and preserving ecological validity. This approach is commonly used in classroom-based educational research involving repeated measurement of the same learners over time (Creswell & Creswell, 2018). The study was conducted in the school smart classroom, where all pupils had access to the digital facilities needed for the intervention.

Instruments

The vocabulary test used in this study was adapted from Year 5 English examination practice materials following the Ujian Akhir Sesi Akademik (UASA; Academic Session End Assessment) format and was aligned with the Year 5 DSKP and CEFR A1–A2 descriptors (Kementerian Pendidikan Malaysia, 2020). The complete UASA English Language assessment consists of 50 items covering different language constructs according to the official Item Specification Table. As the study focused specifically on vocabulary learning, 14 items representing the vocabulary component were selected to provide focused coverage of the assessed construct and the relevant learning outcomes.

The test consisted of nine multiple-choice items and five fill-in-the-blank items covering three vocabulary-related task types: short texts, cloze text, and word completion. The short-text items assessed pupils' understanding of vocabulary within simple texts, while the cloze-text items assessed their ability to select appropriate words based on contextual information. The word-completion items assessed pupils' ability to identify appropriate vocabulary using contextual clues. Different sets of 14 items were administered at the pre-test, immediate post-test, and delayed post-test, while maintaining the same test structure, item formats, and targeted learning outcomes across the three assessment points.

To establish content validity, the instrument was reviewed by the Head of the English Language Unit, who also served as a member of the state examination item panel. The review considered the alignment of the items with the Year 5 DSKP, their appropriateness for the pupils' CEFR A1–A2 proficiency level, clarity of wording and instructions, relevance to the intended vocabulary learning outcomes, and suitability of item difficulty. Based on the review, several revisions were made to improve the suitability of the test. In particular, the reading comprehension section was replaced with a cloze-text section because it was considered to assess grammatical understanding more than vocabulary knowledge. Other items were also revised to better match the proficiency level of Year 5 pupils.

A pilot study was conducted with 10 Year 5 pupils of similar English proficiency who were not involved in the main study. The pilot examined the internal consistency and clarity of the vocabulary tests, the feasibility of the administration procedures, and the implementation of the Duolingo activities. As the test items were scored dichotomously as correct (1) or incorrect (0), internal consistency was assessed using the Kuder–Richardson Formula 20 (KR-20). The KR-20 coefficients were .614 for the pre-test, .531 for the immediate post-test, and .600 for the delayed post-test, indicating low to modest internal consistency, with the immediate post-test showing the lowest reliability. The pilot also showed that some pupils required additional guidance because of their limited familiarity with the application. Consequently, additional demonstrations, clearer step-by-step instructions, and more structured scaffolding were incorporated into the intervention procedures used in the main study.

Intervention Procedure

The intervention lasted four weeks and was implemented twice a week in the school smart classroom. Each session lasted 30 minutes, giving a total exposure of 240 minutes. During the first session, pupils were introduced to the

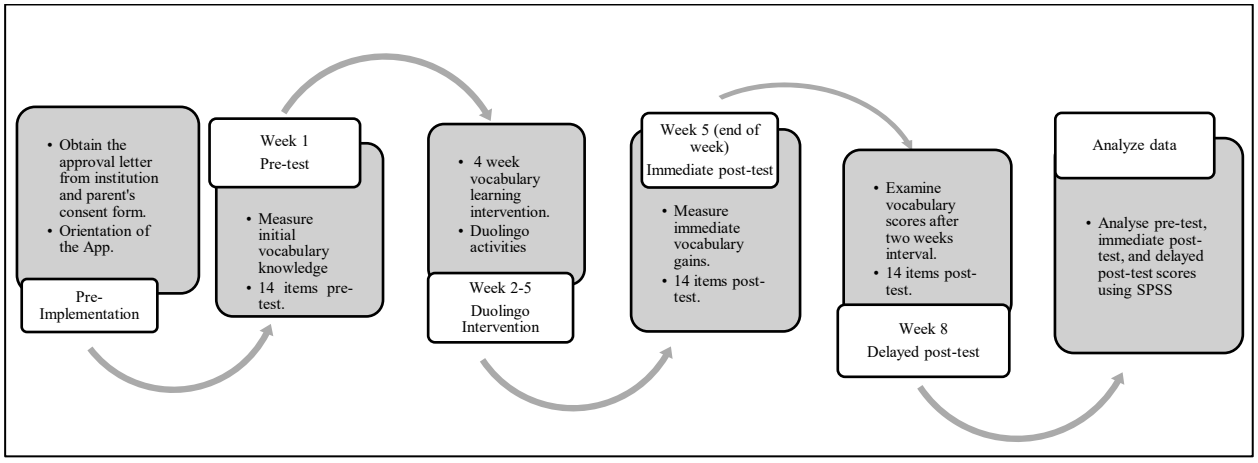
Duolingo application, including the interface, login procedures, and gamified features such as experience points, leaderboards, hearts, and immediate feedback. Pupils logged in using their DELIMa Google accounts so that each pupil could access an individual learning profile.

The researcher first demonstrated how to complete the Duolingo exercises using the smart screen in front of the class. Pupils then completed the assigned beginning-level English activities independently during the practice sessions. The activities covered topics including *Solo Trip, Delivery, At School, Chores, Health, Innovation,* and *Daily Activities*. These activities provided vocabulary practice related to travel, food, school activities, household responsibilities, health, technology, and everyday routines. These thematic areas broadly corresponded with vocabulary themes in the Year 5 *English Plus* textbook, including school, food and health, daily routines, and travel. However, the study did not use a predetermined list of target vocabulary or establish a one-to-one correspondence between individual vocabulary items encountered in Duolingo and individual test items. Thus, the alignment between the Duolingo activities and the vocabulary assessment was primarily at the thematic, proficiency, and curriculum levels rather than at the level of specific vocabulary items.

Data Collection Procedure

Data collection followed a structured eight-week schedule. In Week 1, pupils completed the pre-test to measure their initial vocabulary knowledge. Weeks 2 to 5 were devoted to the Duolingo intervention. At the end of Week 5, the immediate post-test was administered. Two weeks later, in Week 8, the delayed post-test was conducted to examine pupils' vocabulary scores following the intervention. All tests were administered under standardised classroom conditions to maintain consistency across the three measurement points. Between the immediate post-test and the delayed post-test, no further researcher-led Duolingo intervention sessions were conducted. However, pupils' independent use of Duolingo and their exposure to the relevant vocabulary through regular classroom learning during the two-week interval were not monitored. Figure 1 illustrates the sequence of research activities from the pre-implementation phase through the intervention, assessment, and data-analysis phases.

Figure 1
Data Collection Procedure



Data Analysis

The data were analysed using descriptive and inferential statistics. Means and standard deviations were calculated to summarise pupils' vocabulary scores across the three test phases. A repeated measures ANOVA was used to determine whether there were significant differences in scores between the pre-test, immediate post-test, and delayed post-test. Mauchly's Test of Sphericity was conducted to check the sphericity assumption. When the assumption was violated, the Greenhouse-Geisser correction was applied. Where significant differences were found, Bonferroni-adjusted

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pairwise comparisons were conducted. Effect size was reported using partial eta squared to show the practical significance of the intervention. The significance level was set at .05.

Ethical Considerations

School permission was obtained before the study began. Informed consent was collected from parents or guardians, and pupils participated voluntarily. Pupils were informed that they could withdraw at any time without penalty. All data were treated confidentially, and no identifying information was included in the final report. The intervention was conducted in a way that did not disrupt normal classroom teaching and ensured that all participants were treated fairly.

Results

This section presents the results of the study on Duolingo-supported vocabulary practice among Year 5 ESL pupils. Vocabulary scores were obtained at three testing occasions: pre-test, immediate post-test, and delayed post-test. Descriptive statistics were used to summarise pupils' vocabulary scores across the three measurement points, with a maximum possible score of 14 for each test. A repeated measures ANOVA was then conducted to examine whether there were significant differences in vocabulary scores across the three testing occasions.

Pupils' Vocabulary Scores Across the Three Testing Occasions

The results show a clear upward trend in pupils' vocabulary scores across the three testing occasions. The descriptive statistics are presented in Table 1.

Table 1

Mean and Standard Deviation of Pupils' Vocabulary Scores

Test	Mean	Std. Deviation	n
Pre-test	7.90	2.218	30
Immediate post-test	9.57	1.813	30
Delayed post-test	10.93	1.363	30

Note. n = 30. Maximum possible vocabulary-test score = 14.

As shown in Table 1, the mean score increased from 7.90 in the pre-test to 9.57 in the immediate post-test. The mean score further increased to 10.93 in the delayed post-test. This shows that pupils' vocabulary scores improved across the three testing occasions. The standard deviation decreased from 2.218 in the pre-test to 1.813 in the immediate post-test and 1.363 in the delayed post-test. This indicates that the distribution of pupils' scores became more homogeneous.

Significant Differences in Vocabulary Scores Across Time

A repeated measures ANOVA was conducted to determine whether the differences in pupils' vocabulary scores across the pre-test, immediate post-test, and delayed post-test were statistically significant. Mauchly's test indicated that the assumption of sphericity was violated, $p < .001$. Therefore, the Greenhouse–Geisser correction ($\varepsilon = .644$) was applied, $F(1.29, 37.35) = 60.66$, $p < .001$, $\eta p^2 = .68$. Table 2 presents the repeated measures ANOVA result.

Table 2

Repeated Measures ANOVA Result

Effect	F	df_1	df_2	p	ηp^2
Time	60.66	1.29	37.35	< .001	.68

Note. n = 30. Greenhouse–Geisser correction was applied due to violation of sphericity. α = .05.

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The repeated measures ANOVA result showed a statistically significant effect of time on vocabulary scores, $F(1.29, 37.35) = 60.66$, $p < .001$, $\eta p^2 = .68$. This indicates that pupils' vocabulary scores differed significantly across the three testing occasions. The partial eta squared value suggests a large effect size (Cohen, 1988).

Pairwise Comparisons of Vocabulary Scores

Bonferroni-adjusted pairwise comparisons were conducted to identify where the significant differences occurred. Table 3 presents the pairwise comparison results of vocabulary scores across the three testing occasions.

Table 3

Pairwise Comparisons of Vocabulary Scores Across Time Points

Comparison	Mean Difference	p	Cohen's d	95% Confidence Interval for Difference	
				Lower bound	Upper Bound
Immediate post-test vs. Pre-test	1.67	<.001	.94	.846	2.487
Delayed post-test vs. Pre-test	3.03	<.001	1.71	2.212	3.855
Delayed post-test vs. Immediate post-test	1.37	<.001	1.78	1.012	1.722

Note. n = 30. p values were Bonferroni-adjusted. α = .05.

The pairwise comparison results showed significant differences between all three testing occasions. Pupils' immediate post-test scores were significantly higher than their pre-test scores (Mean Difference = 1.67, 95% CI (0.846, 2.487), $p < .001$), with a large effect (d=.94). This indicates that pupils showed significant vocabulary improvement after the four-week Duolingo-supported vocabulary intervention.

The delayed post-test scores were also significantly higher than the pre-test scores (Mean Difference = 3.03, 95% CI [2.212, 3.855], $p < .001$), with a large effect ($d = 1.71$). In addition, the delayed post-test scores were significantly higher than the immediate post-test scores (Mean Difference = 1.37, 95% CI [1.012, 1.722], $p < .001$), also with a large effect ($d = 1.78$). These results indicate that pupils performed significantly better at the delayed post-test than at both earlier testing occasions.

The results indicate that the mean vocabulary scores differed substantially across the three assessment points relative to the variability of pupils' scores. However, these differences should be interpreted cautiously because the study involved a single intact class without a control group. Taken together, the results answer both research questions. In relation to the first research question, pupils' vocabulary scores increased significantly after the four-week Duolingo-supported vocabulary intervention. In relation to the second research question, pupils' delayed post-test scores were significantly higher than their immediate post-test scores. Although the effect sizes indicate the magnitude of the observed score differences, they do not independently establish a causal effect of Duolingo or confirm vocabulary consolidation.

Discussion

This section discusses the findings in relation to the research questions, previous studies, and the theoretical framing of Mobile-Assisted Language Learning (MALL), Krashen's Input Hypothesis, and the Affective Filter Hypothesis.

The findings suggest that Duolingo-supported vocabulary practice was associated with improved vocabulary scores among the Year 5 ESL pupils. The increase from the pre-test to the immediate post-test indicates that pupils performed better after the four-week intervention. This finding is consistent with previous studies which suggest that mobile-assisted language learning can support vocabulary development by providing flexible, repeated, and interactive practice opportunities (Al-Ahdal & Alharbi, 2021; Burston, 2015; Govindasamy et al., 2019; Pang & Aziz, 2021). For

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example, Govindasamy et al. (2019) found that Malaysian ESL pupils who used mobile phones for vocabulary learning demonstrated better vocabulary performance than those who relied on printed dictionaries. Similarly, Pang and Aziz (2021) reported generally positive vocabulary-learning outcomes across studies using mobile-assisted learning platforms, particularly where the platforms provided accessible and supplementary opportunities for vocabulary practice. These findings are comparable with the present study, in which pupils' vocabulary scores also improved following mobile-assisted vocabulary practice.

One possible explanation for the improvement is that pupils were not required to use Duolingo completely on their own. The researcher introduced the application, demonstrated the exercises, explained the gamified features, and then allowed pupils to complete the assigned activities independently. This combination of teacher guidance and independent practice may have helped pupils become familiar with the application while still giving them opportunities to practise vocabulary at their own pace. However, because teacher-guided and independent practice were not compared as separate conditions, their respective contributions to the improvement in vocabulary scores cannot be determined. The combination should therefore be viewed as a practical feature of the intervention rather than a factor shown to have independently produced the observed improvement.

This is particularly important in the primary ESL context. Young learners may require clearer instructions, teacher demonstration, and classroom support when using digital tools for language learning. Previous Duolingo studies have often focused on older learners, including secondary, tertiary, vocational, or adult learners, who may have stronger self-regulation and greater experience using learning applications (Hia et al., 2024; Loewen et al., 2019; Pramesti et al., 2025; Rahman et al., 2025; Zeng & Fisher, 2024). Therefore, the present study adds preliminary classroom-based evidence from a younger primary ESL context.

The findings also suggest the potential of Duolingo as a gamified vocabulary practice tool. Duolingo's short lessons, immediate feedback, points, hearts, streaks, and leaderboard features may have supported pupils' engagement during the vocabulary activities. This is consistent with previous research suggesting that game-based and interactive learning can support learner engagement and vocabulary learning (Ali & Ghazali, 2016; Chen et al., 2018; Lee, 2023; Sailer & Homner, 2020). However, these features were not examined as separate variables in the present study. Therefore, their individual effects on pupils' vocabulary scores cannot be determined.

The delayed post-test score was significantly higher than both the pre-test and immediate post-test scores, indicating that pupils maintained higher vocabulary scores two weeks after the intervention. The increase beyond the immediate post-test is noteworthy, but it should not be interpreted as direct evidence of vocabulary retention or consolidation because pupils' exposure to relevant vocabulary during the two-week interval was not fully controlled.

In the Malaysian primary ESL context, pupils may also have limited exposure to English outside the classroom. Malay or other mother tongues may be more dominant in pupils' home and community environments, reducing opportunities for English vocabulary practice beyond school (Chai et al., 2020; Manap et al., 2025; Ni & Yunus, 2020). Within the present intervention, Duolingo provided additional opportunities for repeated vocabulary practice alongside regular classroom instruction.

The finding may also be interpreted through Krashen's Input Hypothesis and Affective Filter Hypothesis. Duolingo may have provided scaffolded vocabulary input that was suitable for pupils' beginner-level proficiency, while its gamified features may have created a lower-pressure environment for vocabulary practice (Krashen, 1982). However, this explanation should be interpreted cautiously because the present study did not directly measure pupils' motivation, anxiety, or input level.

The continued improvement from the immediate post-test to the delayed post-test also needs careful interpretation. Although pupils maintained higher vocabulary scores at the delayed post-test, the one-group pre-experimental design limits the interpretation of this pattern. Without a control group, the improvement cannot be attributed solely to Duolingo. Other factors, such as familiarity with the test format, regular classroom learning, independent use of Duolingo outside the formal intervention, and vocabulary reinforcement through the brief teacher-led review conducted after each intervention session may also have contributed to pupils' vocabulary scores at the delayed post-test.

The findings suggest that Duolingo may be useful as a supplementary tool for vocabulary instruction in primary ESL classrooms. It can provide short, repeated, and interactive vocabulary practice, which may suit young learners' needs. In the present study, Duolingo was implemented alongside teacher guidance and regular classroom instruction rather than as a stand-alone approach. Based on this intervention context, teachers may consider using Duolingo as a guided support activity in which they introduce relevant vocabulary, demonstrate app-based tasks, monitor pupils' progress, and conduct brief review sessions after practice. However, the study did not compare supplementary and stand-alone implementation and therefore cannot determine which approach is more effective.

This implication is consistent with MALL research, which suggests that mobile learning tools are most useful when they are meaningfully integrated into instruction rather than used as isolated digital activities (Burston, 2015; Pang & Aziz, 2021). For primary ESL pupils, teacher guidance is especially important because young learners may need support to connect app-based practice with classroom vocabulary learning.

The findings also suggest that schools need to provide suitable digital facilities, stable internet access, and basic teacher training if mobile-assisted vocabulary learning is to be implemented effectively. Without adequate infrastructure and teacher support, the pedagogical potential of Duolingo may not be fully realised, especially in schools with limited digital resources.

Conclusion

This study examined Duolingo-supported vocabulary learning among Year 5 ESL pupils in a Malaysian primary school. Pupils' vocabulary scores increased from the pre-test to the immediate post-test and remained higher at the delayed post-test. These findings suggest that Duolingo, when used as a structured and teacher-supported activity, may help strengthen pupils' vocabulary learning. However, the higher delayed post-test scores should be interpreted cautiously because continued classroom learning, independent practice, repeated exposure to relevant vocabulary, and other uncontrolled factors may also have contributed to pupils' scores.

The study provides preliminary classroom-based evidence on the use of a gamified mobile-assisted language learning tool with younger ESL learners, a group that has received comparatively less attention in Duolingo research. In this study, Duolingo was implemented alongside teacher demonstration, monitoring, and brief review activities rather than as a stand-alone application. This suggests that teacher support may be a useful practical feature when integrating Duolingo into primary ESL vocabulary instruction, although its specific contribution was not independently examined in this study.

Overall, the findings suggest that Duolingo may support vocabulary learning in primary ESL classrooms when implemented as a structured, teacher-supported activity. Its gamified tasks, repeated practice, and immediate feedback may encourage pupil participation, although the individual contribution of these features was not examined in the present study.

Limitations and Future Studies

This study has several limitations. First, it involved one intact class of 30 Year 5 pupils from one primary school in Kedah, which limits the generalisability of the findings. Second, the one-group design did not include a control group, and the intervention combined Duolingo practice, teacher demonstration, and whole-class vocabulary review. Therefore, the observed score changes cannot be attributed solely to Duolingo or to any single component of the intervention. Third, although the Duolingo activities broadly corresponded with vocabulary themes in the Year 5 curriculum, item-level alignment between vocabulary encountered in Duolingo and vocabulary assessed in the tests was not established. Finally, pupils' independent use of Duolingo and exposure to relevant vocabulary during the two-week interval before the delayed post-test were not monitored, which may have influenced the delayed post-test results. Future research should address these limitations by using control or comparison groups, larger samples, and longer intervention periods. Future studies may also compare Duolingo-supported vocabulary practice with other forms of vocabulary instruction or other digital learning tools. To better understand the contribution of different intervention components, researchers could compare Duolingo practice with and without teacher guidance or whole-class

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vocabulary review. Pupils' use of Duolingo and exposure to relevant vocabulary outside the formal intervention should also be monitored more systematically, particularly during the interval before the delayed post-test.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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