

The Impact of Duolingo as a Learning Tool to Improve English Vocabulary for EFL Learners

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Abstrak

The Penggunaan Duolingo sebagai alat pembelajaran bahasa yang dibantu perangkat seluler telah mendapatkan popularitas untuk meningkatkan penguasaan kosakata di kalangan pembelajar Bahasa Inggris sebagai Bahasa Asing (EFL). Meskipun ada penelitian tentang efektivitas jangka pendeknya, masih ada pertanyaan tentang dampak jangka panjangnya dan mekanisme kognitif yang terlibat. Studi ini menyelidiki peran Duolingo dalam meningkatkan retensi kosakata melalui desain eksperimental kuantitatif yang melibatkan 60 pembelajar EFL berusia 16–22 tahun. Partisipan, yang dipilih melalui pengambilan sampel bertujuan, menggunakan Duolingo selama setidaknya satu bulan. Data dianalisis menggunakan analisis regresi linier dan analisis korelasi Pearson melalui SPSS untuk menentukan efektivitas alat tersebut. Temuan menunjukkan peningkatan retensi kosakata yang signifikan secara statistik, menyoroti potensi Duolingo sebagai platform yang interaktif, mudah diakses, dan berbasis gamifikasi untuk pembelajaran mandiri. Hasil ini menggarisbawahi nilainya dalam mengatasi kesenjangan dalam metode kelas tradisional, menawarkan wawasan praktis kepada pendidik tentang integrasi teknologi ke dalam desain kurikulum. Penelitian ini berkontribusi pada pemahaman tentang alat bantu seluler, mempromosikan skalabilitasnya untuk berbagai konteks pendidikan.

Kata Kunci: Duolingo, Akuisisi Kosakata, Pembelajaran Bahasa dengan Bantuan Perangkat Seluler (MALL), Bahasa Inggris sebagai Bahasa Asing (EFL)

Abstract

The use of Duolingo as a mobile-assisted language learning tool has gained prominence for enhancing vocabulary acquisition among English as a Foreign Language (EFL) learners. Despite existing research on its short-term effectiveness, questions remain about its long-term impact and the cognitive mechanisms involved. This study investigates the role of Duolingo in improving vocabulary retention through a quantitative experimental design involving 60 EFL learners aged 16–22 years. Participants, selected through purposive sampling, engaged with Duolingo for at least one month. Data were analyzed using linear regression analysis and Pearson correlation analysis via SPSS to determine the tool's efficacy. The findings reveal a statistically significant improvement in vocabulary retention, highlighting Duolingo's potential as a gamified, interactive, and accessible platform for self-paced learning. These results underscore its value in addressing gaps in traditional classroom methods, offering educators practical insights into integrating technology into curriculum design. This research contributes to the understanding of mobile-assisted tools, promoting their scalability for diverse educational context.

Keywords: Duolingo, Vocabulary Acquisition, Mobile-Assisted Language Learning (MALL), English as a Foreign Language (EFL)

INTRODUCTION

In recent years, mobile-assisted language learning (MALL) applications have emerged as essential tools for enhancing English as a Foreign Language (EFL) education. These applications have transformed traditional approaches by integrating technology with language instruction, enabling learners to engage with content in dynamic and interactive ways. Among these tools, Duolingo stands out due to its widespread popularity and innovative design, offering a gamified approach to language learning. With its user-friendly interface, interactive exercises, vocabulary drills, and structured lessons, Duolingo supports flexible, self-paced learning that caters to the diverse needs of modern EFL learners. Its accessibility and adaptability make it a valuable resource for students and educators alike, particularly in contexts where conventional teaching methods face practical limitations.

The significance of Duolingo in vocabulary acquisition for EFL students lies in its ability to make learning both engaging and effective. Vocabulary mastery is widely recognized as a fundamental component of language proficiency, directly influencing learners' competencies in reading, writing, speaking, and listening. Despite its importance, vocabulary acquisition often poses significant challenges for EFL learners, who may struggle with retention and application, particularly in environments where exposure to the target language is limited. Traditional classroom instruction, while effective to an extent, frequently lacks the individualized attention and repetition necessary for durable vocabulary learning. Duolingo addresses these gaps by incorporating gamification elements, adaptive learning techniques, and spaced repetition systems, which together foster an environment conducive to sustained vocabulary development.

Empirical studies have consistently highlighted Duolingo's positive impact on EFL vocabulary acquisition. For instance, Muddin (2018) demonstrated that learners who used Duolingo experienced significant improvements in vocabulary retention, attributing these gains to the platform's engaging and interactive features. Similarly, DW (2020) found that Duolingo outperformed conventional teaching methods in fostering vocabulary mastery, with learners reporting enhanced motivation and comprehension. Cesarini et al. (2021) corroborated these findings, emphasizing the platform's effectiveness in promoting active engagement and sustained learning. More recently, Irzawati (2023) expanded on these outcomes, noting that Duolingo not only improved vocabulary retention but also contributed to broader language skill development and increased learner motivation. Collectively, these studies underscore Duolingo's potential to revolutionize EFL education by addressing key challenges in vocabulary acquisition. However, much of the existing research focuses on short-term outcomes, leaving critical questions about the platform's long-term efficacy and the specific cognitive strategies it employs largely unexplored.

To address these research gaps, the current study examines both the immediate and long-term effects of Duolingo on vocabulary retention among EFL learners. While previous studies provide compelling evidence of Duolingo's short-term benefits, there is a need to investigate how these advantages persist over time and to identify the cognitive mechanisms that underpin sustained vocabulary learning. By exploring these dimensions, this research aims to contribute a more comprehensive understanding of Duolingo's role within the MALL framework, offering insights that extend beyond immediate learning gains to encompass

enduring educational impacts.

The implications of this study extend to both theoretical and practical domains. From a theoretical perspective, the research seeks to enhance the understanding of Duolingo's impact on vocabulary acquisition within the broader context of MALL technologies. By examining the platform's features and their influence on cognitive processes, the study aims to illuminate the mechanisms through which digital tools can support long-term language learning. Practically, the findings are expected to provide actionable recommendations for EFL educators and curriculum designers, offering guidance on how to effectively integrate MALL applications like Duolingo into language instruction. By bridging the gap between traditional teaching methods and technology-enhanced learning, this research has the potential to advance pedagogical practices and optimize vocabulary education for diverse learner populations.

Ultimately, this study aspires to provide insights that inform both the design and implementation of digital language learning tools. By addressing the limitations of existing research and exploring new dimensions of Duolingo's impact, the study aims to contribute to the growing body of knowledge on MALL technologies. Its findings are anticipated to have significant implications for EFL education, offering a roadmap for leveraging digital innovations to enhance language proficiency and learner engagement. Through a comprehensive investigation of Duolingo's immediate and long-term effects, this research seeks to pave the way for more effective and sustainable approaches to vocabulary acquisition in EFL contexts.

LITERATURE REVIEW

English Learning Tools The Role of Digital and Emerging Technologies in Enhancing English Language Learning: Opportunities and Challenges

Digital tools and technologies have proven to significantly enhance English language learning across a range of contexts, user groups, and proficiency levels. Duolingo, for instance, has demonstrated substantial benefits for working adults in China, enabling them to improve their English independently with positive perceptions reported across proficiency levels (Su, 2022). Similarly, the Duolingo school program has shown value in educational settings, although concerns about grading rubrics and platform usability were noted by educators, suggesting that addressing these gaps could optimize classroom experiences (Neuschafer, 2024). Google digital tools were particularly well-received by first-year Vietnamese university students, highlighting the importance of accessibility and engagement in online learning (Thuan, 2023). ICT tools further contributed to English acquisition during the pandemic, fostering collaborative, self-paced, and learner-controlled learning methods (Madhavi, 2023). Moreover, Quizlet emerged as an effective tool for vocabulary enhancement, offering practical integration strategies for educators (Tran, 2023). These findings illustrate the flexibility and effectiveness of various digital tools—whether apps, platforms, or ICT resources—in supporting English language learning for independent learners and within formal educational contexts. However, the scalability of these tools, particularly in addressing diverse learner needs, remains an area for continuous development. As educational contexts diversify, the adaptability and inclusivity of these tools must be continually assessed to ensure broader accessibility and effectiveness across different learner demographics.

Emerging technologies, such as AI and hybrid solutions, are proving to be highly effective in enhancing English language education. AI tools, frequently used by Vietnamese high school students, have successfully improved core language skills while promoting self-directed learning (Quyet, 2024). Similarly, the combination of IoT with Generative AI has introduced innovative oral assessment methods that dynamically adapt to learners' needs, offering more personalized learning experiences (Dong, 2024). The hybrid technology of the Osmo™ app has been especially beneficial for dyslexic students, surpassing traditional methods in vocabulary retention (Eden, 2023). Additionally, WhatsApp bots have proven effective in vocabulary acquisition across proficiency levels, while the PCUSELL model has shown how apps based on Self-Determination Theory can effectively motivate learners and enhance engagement (Annamalai, 2022; Ghaithi, 2024). Game-based learning elements were also highlighted as a means to improve language acquisition for young learners facing challenges with dialect translation (Ibrahim, 2024). These advancements demonstrate the potential of AI and hybrid technologies to address specific language learning challenges, offering tailored solutions in diverse educational contexts. Nonetheless, while promising, these technologies require further exploration regarding their adaptability, ease of use, and integration with existing teaching practices to maximize their potential. The successful implementation of such tools will depend not only on their technological innovation but also on teachers' readiness to adopt them in ways that complement traditional educational methods.

The exploration of digital tools and emerging technologies in English language learning highlights both the opportunities and challenges of integrating these tools into educational practices. While platforms like Duolingo and Quizlet show measurable success in fostering independent learning and vocabulary acquisition, concerns around platform usability and the need for stronger grading systems continue to limit their effectiveness in classroom integration. Moreover, ICT tools and apps, while engaging and flexible, often depend heavily on factors such as user accessibility and motivation, which can impact their overall efficacy. The advent of AI-driven tools and hybrid technologies like IoT-integrated assessments and specialized apps for dyslexic learners marks a significant leap forward in personalizing language learning, yet these advancements highlight the need for more comprehensive pedagogical frameworks that can bridge the gap between technological innovation and practical classroom application. Additionally, while strategies like gamification and AI-driven methods hold promise for enhancing learner engagement, their broader applicability and scalability across diverse learner groups and contexts remain uncertain. These observations underscore the need for an ongoing dialogue between technological developers and educators to create balanced, context-sensitive solutions that maximize the potential of digital tools and emerging technologies in English language learning. As the field continues to evolve, the integration of such technologies must be guided by clear educational goals, ensuring that technological advances serve to enhance, rather than complicate, the language learning experience.

English skills development: The Innovative Approaches and Strategies for Enhancing English Language Learning

The development of English skills is supported by a variety of tools and strategies, each

contributing in unique ways to language acquisition. Duolingo's interactive listening exercises and speech recognition have proven to enhance basic language skills like reading and listening, enabling some learners to exceed expected proficiency levels (Jiang, 2024; Olimat, 2024). However, its ability to address more advanced skills, such as pronunciation, is limited, suggesting the need for complementary methods (Taylor, 2024). In addition, blended learning approaches, including Virtual Literature Circles (VLCs), have demonstrated their effectiveness in promoting vocabulary acquisition, reading comprehension, and flexible engagement in both synchronous and asynchronous learning environments (Albatti, 2023; El-Esery, 2023). Similarly, multimodal digital assessments, like those used in the English for Architects and Civil Engineers course in Germany, have been shown to support technical communication skills alongside traditional language proficiency (Hellwig, 2022). These findings emphasize the importance of integrating digital and traditional methods to foster comprehensive skill development, addressing multiple aspects of language proficiency, and catering to different learner needs.

Interactive and adaptive learning strategies contribute significantly to enhancing English language proficiency. "Study with Me" sessions in Austrian secondary schools, for example, have helped students improve self-regulation and reduce distractions, though their direct impact on language learning remains less clear (Moore, 2024). Classroom interaction, however, continues to play an essential role in addressing challenges in language learning, with sustained teacher-student engagement fostering cognitive improvements and enhanced language proficiency (Shawaqfeh, 2024). Game-based learning and teaching English literature have also been shown to improve reading comprehension and academic performance, highlighting the effectiveness of interactive methods in diverse educational settings (Olayvar, 2023; Huijun, 2024). Additionally, online listening practice tools have provided valuable insights into creating more effective language learning apps (Huong, 2024). These findings underscore the critical role of interactive and adaptive strategies, making language acquisition not only more engaging but also more tailored to individual learner needs and contexts, enhancing both academic and practical outcomes.

This review highlights the broad spectrum of tools and strategies available for developing English skills, yet suggests areas for further research into their integration and broader applicability. While Duolingo and other digital platforms show promise in improving basic skills such as reading and listening, their limitations in more advanced areas like pronunciation underscore the need for complementary and targeted approaches. The effectiveness of blended learning and virtual strategies is well-supported, but their generalizability across various learner contexts requires deeper investigation to understand their broader impact. Furthermore, while interactive methods like "Study with Me" sessions and game-based learning demonstrate clear benefits, their direct application in non-academic contexts and their contribution to holistic language learning need to be further explored. While multimodal assessments and adaptive teaching strategies hold significant promise, practical challenges related to resource availability and learner readiness must be addressed to ensure their successful implementation. These findings suggest that while current methods are effective in many contexts, additional research into their scalability, long-term impact, and integration into diverse learning environments is essential for optimizing English language acquisition.

Gamification and Emerging Technologies in Vocabulary Development

The integration of diverse technological and pedagogical tools has significantly enhanced vocabulary learning across various contexts. Mobile learner-generated content (m-LGC) tools have shown that active engagement leads to superior vocabulary outcomes and sustained motivation among learners (Song, 2023). Similarly, digital storytelling (DST) improved vocabulary acquisition and motivation among Omani EFL learners, demonstrating the potential of creative instructional methods (Ghaithi, 2023). Augmented Reality-enhanced game-based learning (ARGBL) in flipped classrooms has further proven effective in promoting both vocabulary learning and creative thinking (Hung, 2023). Innovations such as 5G and cloud computing platforms facilitate personalized and interactive vocabulary learning experiences, transcending geographical and temporal limitations (Wang, 2023). TED Talks and TED-Ed animations have also been highlighted as valuable resources for teaching English for science and technology (EST), bridging gaps between general and specialized English learning (Liu, 2023). Additionally, text-mining technology has shown promise for optimizing vocabulary learning in educational contexts (Wang, 2024), while tools designed to assess vocabulary learning strategies provide practical applications for time-sensitive environments (Chou, 2024). These studies emphasize the transformative role of technological advancements in vocabulary acquisition, with each tool presenting unique advantages depending on the learners' needs and the context in which they are used. The potential of these tools to enhance vocabulary learning outcomes is clear, though their effectiveness remains closely tied to the manner in which they are implemented and the extent to which they engage learners.

Contextual and tailored approaches also play a pivotal role in vocabulary acquisition. Early childhood education research in Indonesia demonstrates a strong correlation between numeracy and vocabulary skills, emphasizing the importance of home literacy and targeted preschool activities (Novita, 2024). At the tertiary level, addressing low vocabulary proficiency requires focusing on academic vocabulary elements like word lists, multiword units, and word parts to meet learners' academic needs (Coxhead, 2021). Research on the effectiveness of gamification, specifically game-based language learning models, has highlighted its contribution to enhancing vocabulary acquisition and learning engagement (Panah, 2022). Moreover, learner-related factors, such as cognitive abilities and proficiency levels, significantly impact the effectiveness of vocabulary learning exercises (Teng, 2024). These findings suggest that while technology-driven methods can significantly enhance vocabulary learning, the learner's context—whether their educational stage, cognitive development, or individual learning preferences—must be considered to maximize their effectiveness. Tailoring the learning experience to these factors ensures that learners receive the most relevant and impactful exposure to vocabulary development.

The integration of diverse technological tools in vocabulary learning has undeniably shown promising results, offering a wide range of opportunities for engagement and skill enhancement. However, the effectiveness of technologies like mobile learner-generated content, digital storytelling, and augmented reality often hinges on the degree of learner engagement and the contextual factors influencing the learning process. For instance, while these tools have the potential to significantly boost vocabulary acquisition, their success depends on learners' active involvement, as passive participation typically results in limited

progress. Similarly, teaching innovations such as TED Talks and TED-Ed animations have been shown to foster vocabulary growth, but their impact may vary across different learner groups, requiring adaptations to ensure that they meet diverse educational needs. Additionally, learner-specific factors, such as cognitive abilities, academic focus, and external learning environments, must be carefully considered when evaluating the effectiveness of these tools. This highlights the need for more research into how different educational contexts and learner characteristics interact with technological tools to optimize vocabulary learning outcomes. Therefore, while these technological advancements offer promising benefits, their true potential is realized only when they are strategically adapted to fit the unique needs of learners and the demands of specific educational settings.

METHOD

This Research Design

This study employed a quantitative research method with a survey design to assess the impact of Duolingo on improving English vocabulary among EFL learners. A structured questionnaire serves as the primary data collection tool, enabling the study to gather numerical data on learners' perceptions, usage patterns, and vocabulary improvement. The survey design was particularly suitable for collecting and analyzing data from a relatively small sample size, allowing for clear and concise conclusions about Duolingo's effectiveness.

Hypotheses

- H_0 (Null Hypothesis): The use of Duolingo does not significantly impact learners' English vocabulary improvement.
- H_1 (First Alternative Hypothesis): The use of Duolingo significantly improves learners' English vocabulary.
- H_2 (Second Alternative Hypothesis): Learners' frequency of using Duolingo is positively correlated with perceived vocabulary improvement.

These hypotheses provide a clear framework to assess the overall and specific impacts of Duolingo usage on vocabulary learning.

Samples

The study involved 60 EFL learners, aged 16 to 22 years, who are actively enrolled in English courses at secondary schools or universities. The participants were selected through purposive sampling, ensuring they have used Duolingo consistently for at least one month. The sample comprises 30 male and 30 female learners, offering a balanced perspective across genders. Limiting the sample size to 60 allows for in-depth analysis while maintaining feasibility in terms of data collection and management.

Data Collection

Data was gathered using a structured questionnaire, distributed both in printed form and online for ease of access. The questionnaire includes:

- Likert-scale items to measure learners' perceptions of Duolingo's ease of use, engagement, and impact on vocabulary.
- Multiple-choice questions to capture information on usage patterns, including frequency, duration, and features used within Duolingo.
- Demographic questions to collect data on age, gender, and educational background.

Participants completed the questionnaire independently to ensure accurate and unbiased responses. Anonymity and confidentiality are maintained throughout the data collection process.

Validity and Reliability

To ensure validity, the questionnaire is designed using existing frameworks for evaluating digital learning tools and vocabulary acquisition. Expert reviews by ELT specialists and educational researchers confirm its relevance and alignment with the study objectives. The reliability of the instrument is measured using Cronbach's alpha to assess the internal consistency of the Likert-scale items. A coefficient of 0,7 or higher is targeted to confirm that the questionnaire provides stable and consistent measurements across participants.

Data Analysis

The data analysis for this study involving 60 EFL learners showed that the use of the Duolingo application has a significant effect on vocabulary improvement. Based on descriptive analysis, the average used of Duolingo was 21,27 with a standard deviation of 2,455, while the average vocabulary increase reached 21,28 with a standard deviation of 2,148. The results of the linear regression test showed that the use of Duolingo has a significant positive effect on vocabulary improvement, with a coefficient of 0,735 ($p < 0.001$) and a t-value of 11,804. In addition, the Pearson correlation test revealed a very strong positive relationship between Duolingo usage and vocabulary improvement, with a correlation coefficient of 0,840 ($p < 0,001$). These results support the hypothesis that Duolingo is effective as a vocabulary learning tool and makes an important contribution to the development of technology-based language learning in EFL contexts.

FINDINGS AND DISCUSSION

FINDINGS

The descriptive statistics presented in Table 1 provide an overview of the frequency of Duolingo usage and the perceived vocabulary improvement among the participants. The average frequency of Duolingo usage was 21,27 times per month, with a standard deviation (SD) of 2,455, indicating a moderate level of variation in the frequency of usage among the participants. Meanwhile, the average perception of vocabulary improvement scored 21,28 on a 5-point Likert scale, with a slightly lower standard deviation of 2,148, reflecting relatively consistent perceptions among participants.

Table 1: Statistical Descriptive
Descriptive Statistics

	N	Minimu m	Maximu m	Mean	Std. Deviation
Penggunaan Duolingo(X)	60	13	25	21,27	2,455
Peningkatan Kosakata(Y)	60	15	25	21,28	2,148
Valid N (listwise)	60				

Table 2: The effect of using Duolingo (H_0 and H_1): Linear Regression Analysis
Coefficients^a

Model	Unstandardized Coefficients		Standardize d Coefficients		t	Sig.
	B	Std. Error	Beta			
1	(Constant)	5,652	1,333		4,240	<,001
	Penggunaan Duolingo(X)	,735	,062	,840	11,804	<,001

Table 2 highlights the results of the linear regression analysis conducted to test hypothesis H_1 , which posited that the use of Duolingo significantly affects students' vocabulary improvement. The analysis revealed a significant positive effect of Duolingo usage on vocabulary improvement, with an unstandardized regression coefficient (β) of 0,735 ($p < 0,05$). This result suggests that for every unit increase in Duolingo usage, there is an estimated 0,735-point increase in the perceived vocabulary improvement score, underscoring the substantial contribution of Duolingo as a vocabulary learning tool.

The standardized coefficient (Beta) of 0,840 further emphasizes the strong effect of Duolingo usage on vocabulary improvement. The t-statistic of 11,804, with a p-value of <0,001, provides robust evidence against the null hypothesis, allowing the study to confirm the significant impact of Duolingo usage on vocabulary enhancement.

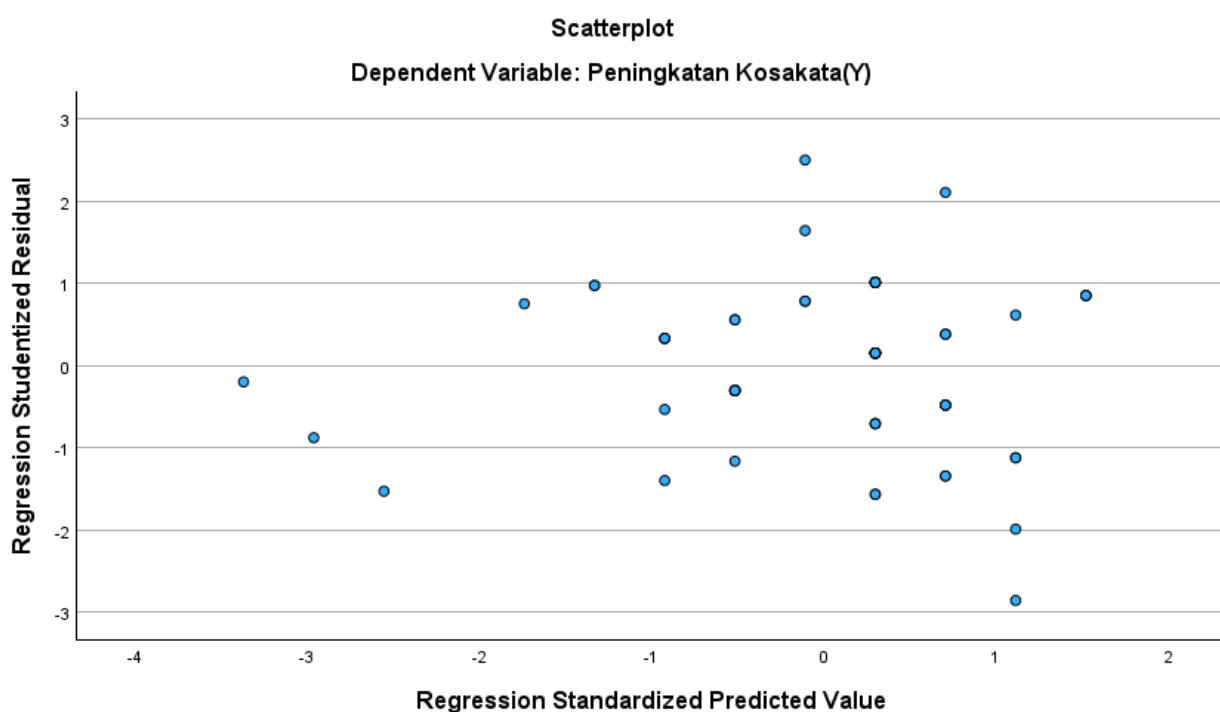
Table 3: Frequency and perception relationship (H_2): Pearson Correlation Analysis
Correlations

		Penggunaan Duolingo(X)	Peningkatan Kosakata(Y)
Penggunaan Duolingo(X)	Pearson Correlation	1	,840**

	Sig. (2-tailed)		<,001
	N	60	60
Peningkatan Kosakata(Y)	Pearson Correlation	,840**	1
	Sig. (2-tailed)	<,001	
	N	60	60

The Pearson correlation analysis presented in Table 3 was conducted to test hypothesis H₂, which posited a relationship between the frequency of Duolingo usage and perceived vocabulary improvement. The results showed a very strong positive correlation between the two variables, with a Pearson correlation coefficient (r) of 0,840 and a significance level of p < 0,001. This indicates that participants who used Duolingo more frequently tended to report higher levels of vocabulary improvement.

Table 4: Visualization of the data



The findings from both the regression and correlation analyses align with the study's primary objective, which was to evaluate the effect of Duolingo usage on EFL learners' vocabulary development. The significant regression results confirm the efficacy of Duolingo as a tool for enhancing vocabulary acquisition, while the high correlation coefficient highlights the strong relationship between usage frequency and perceived improvement.

These results support the integration of technology-driven language learning tools like Duolingo into English language teaching (ELT) curricula, particularly for vocabulary development. The findings are consistent with prior research emphasizing the role of interactive and gamified platforms in engaging learners and promoting language skills

acquisition. Furthermore, the high consistency in participants' perceptions of vocabulary improvement underscores the potential of Duolingo to meet diverse learners' needs, making it a versatile tool in ELT contexts.

Discussion

This study provides compelling evidence for the significant role of Duolingo in enhancing vocabulary acquisition among EFL learners, as reflected by the regression coefficient of 0,735 ($p < 0,001$). This finding aligns with the broader literature emphasizing the effectiveness of digital tools in facilitating English language learning across diverse contexts. Duolingo's interactive features, such as listening exercises and speech recognition, have been shown to improve basic language skills, corroborating findings by Jiang (2024) and Olimat (2024). Additionally, the strong positive correlation (Pearson $r = 0,840$, $p < 0,001$) between Duolingo usage and vocabulary improvement aligns with the effectiveness of mobile learner-generated content (m-LGC) tools in fostering active learner engagement and improving vocabulary outcomes (Song, 2023). These insights demonstrate how technological solutions can effectively support vocabulary learning while also offering flexible and self-paced options for learners.

The high mean scores for Duolingo usage (21,27) and vocabulary improvement (21,28), both approaching the maximum scale value, indicate that learners optimize the app's features for language development. These findings echo Su's (2022) observations of working adults in China, who improved their English proficiency independently through Duolingo, and Madhavi's (2023) analysis of ICT tools during the pandemic, which emphasized collaborative, self-paced, and learner-controlled learning environments. The practical benefits of Duolingo also parallel the success of Google digital tools among first-year Vietnamese university students, as highlighted by Thuan (2023), who noted the importance of accessibility and engagement in online learning.

Despite these strengths, some limitations of Duolingo are evident. Taylor (2024) pointed out that while tools like Duolingo are effective for foundational language skills, they fall short in addressing advanced skills, such as pronunciation and nuanced grammatical structures. This suggests the need for integrating complementary methods, such as classroom interaction and tailored pedagogical strategies. Blended learning approaches, such as Virtual Literature Circles (Albatti, 2023; El-Esery, 2023), offer a potential solution by promoting vocabulary acquisition alongside flexible engagement through synchronous and asynchronous formats. Similarly, TED Talks and TED-Ed animations, highlighted by Liu (2023), bridge general and specialized English learning, complementing apps like Duolingo in addressing learners' diverse needs.

Emerging technologies provide further avenues for enhancing language learning. AI tools, as utilized by Vietnamese high school students, have demonstrated effectiveness in promoting self-directed learning and improving core language skills (Quyet, 2024). Additionally, Dong's (2024) integration of IoT with generative AI for oral assessments

highlights the potential for personalized and adaptive learning experiences. These technologies echo the findings of Eden (2023), who reported that the hybrid Osmo™ app outperformed traditional methods in vocabulary retention for dyslexic students. Similarly, WhatsApp bots have proven effective in vocabulary acquisition across various proficiency levels (Annamalai, 2022), while cloud computing platforms have facilitated personalized learning experiences, enabling scalable solutions for vocabulary development (Wang, 2023). These findings suggest that Duolingo, while effective, could benefit from incorporating elements of AI and hybrid technologies to address specific learning challenges and offer a more personalized experience.

The relevance of gamification in language learning further supports the findings of this study. Hung's (2023) research on ARGBL demonstrated that integrating gamified elements into flipped classrooms enhanced vocabulary acquisition and creative thinking, offering a model that could complement Duolingo's existing features. Similarly, Panah (2022) highlighted the contribution of game-based learning models in increasing learner engagement and vocabulary outcomes. The PCUSELL model, grounded in Self-Determination Theory, reinforces the importance of motivational tools in maintaining learner engagement and promoting sustained vocabulary development (Annamalai, 2022; Ghaithi, 2024). These insights emphasize the potential for Duolingo to further enhance its user experience by integrating gamification strategies that foster both engagement and retention.

Although Duolingo demonstrates significant promise as a vocabulary learning tool, its usability within formal educational contexts remains an area for further exploration. Neuschafer (2024) highlighted concerns about grading rubrics and platform usability within the Duolingo school program, suggesting the need for refinements to optimize its integration into classroom settings. Moore's (2024) study on "Study with Me" sessions in Austrian secondary schools revealed the benefits of self-regulated learning but also highlighted challenges in maintaining sustained engagement over time. These findings underscore the importance of teacher-student interaction in addressing cognitive and language proficiency challenges, as emphasized by Shawaqfeh (2024). Classroom interaction not only enhances academic outcomes but also ensures that technology-based tools complement traditional teaching methods effectively.

The scalability and inclusivity of Duolingo are also critical considerations. Research by Novita (2024) in early childhood education emphasized the importance of contextual factors, such as home literacy and targeted preschool activities, in supporting vocabulary acquisition. At the tertiary level, Coxhead (2021) noted the need for tools that address academic vocabulary through targeted word lists, multiword units, and word parts. Teng (2024) further highlighted the significance of aligning vocabulary exercises with learners' cognitive abilities and proficiency levels. These findings suggest that while Duolingo provides a strong foundation for vocabulary learning, its adaptability to diverse learner contexts—whether in early childhood, secondary education, or higher education—requires continuous development to

maximize its impact.

Technological advancements also offer opportunities for further refining vocabulary learning strategies. Wang's (2024) research on text-mining technology demonstrated its potential for optimizing vocabulary exercises in time-sensitive environments, while multimodal digital assessments, as utilized in Germany for English for Architects and Civil Engineers courses, provided insights into integrating technical communication skills with traditional language learning (Hellwig, 2022). These tools, combined with digital storytelling (Ghaithi, 2023) and mobile platforms (Tran, 2023), highlight the transformative role of innovative technologies in enhancing both academic and practical language skills. The use of 5G and cloud computing platforms, as discussed by Wang (2023), further underscores the potential for real-time, personalized learning experiences that transcend geographical and temporal limitations.

Lastly, the broader pedagogical implications of this study underscore the importance of integrating technology with traditional teaching methods. Classroom interaction and teacher guidance remain critical for fostering a holistic learning experience, as evidenced by studies on WhatsApp bots (Annamalai, 2022), ARGBL (Hung, 2023), and interactive digital platforms (Liu, 2023). While Duolingo effectively promotes vocabulary acquisition, its full potential lies in its integration into broader pedagogical frameworks that leverage complementary tools and strategies. By addressing limitations related to usability, scalability, and adaptability, Duolingo and similar tools can continue to evolve as powerful resources for English language learning.

In conclusion, the findings of this study reinforce the transformative potential of Duolingo as a vocabulary learning tool while highlighting areas for further enhancement. Through the integration of emerging technologies, gamification, and contextual learning strategies, Duolingo can extend its impact across diverse educational contexts. The insights from this study, combined with evidence from the existing literature, provide a comprehensive understanding of how technology-based tools can support vocabulary.

CONCLUSION

This study demonstrates the significant role of Duolingo in enhancing EFL learners' vocabulary acquisition. The findings reveal a robust positive relationship between Duolingo usage and vocabulary improvement, with a regression coefficient of 0,735 and a Pearson correlation coefficient of 0,840. These results suggest that the consistent use of Duolingo contributes substantially to vocabulary development, making it an effective tool for EFL learners. The app's interactive features, which can be utilized for both self-directed learning and integration into classroom instruction, imply its potential as a complementary approach to traditional methods. Additionally, the affordability and flexibility of Duolingo imply its suitability for diverse learning contexts, providing learners with accessible and engaging solutions for language acquisition. These insights suggest that Duolingo not only supports

individual learning goals but also contributes to broader pedagogical strategies in EFL education.

Despite its promising results, this study has several limitations. First, the scope of the study was restricted to vocabulary improvement, leaving other language skills such as pronunciation, grammar, and writing unexplored. Second, the study relied on quantitative measures, limiting the exploration of qualitative aspects such as learner satisfaction and engagement. Third, the findings may not be generalizable to all educational settings, particularly those with limited access to technology or where traditional teaching methods predominate.

Future research should address these limitations by investigating the impact of Duolingo on other language skills to provide a more comprehensive understanding of its efficacy. Additionally, qualitative studies could explore learners' experiences and perceptions of using Duolingo to complement the quantitative findings. Research could also focus on optimizing Duolingo's integration into classroom settings, including the development of strategies for effective teacher facilitation and alignment with curriculum goals. Lastly, comparative studies evaluating Duolingo against other digital tools could offer insights into its relative effectiveness and potential improvements. Such research will help refine the application of technology in EFL education, ensuring its relevance and adaptability across diverse learner needs and contexts.

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