

Duolingo-Based Arabic Vocabulary Acquisition in Islamic Educational Contexts

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Kasmaluddin

Universitas Islam Internasional Darullughah Wadda'wah, Pasuruan, Indonesia

E-mail: kasmaluddin@uiidalwa.ac.id

Abstract

This study investigates the effectiveness of Duolingo-based instruction in enhancing Arabic vocabulary acquisition within Islamic educational contexts. Employing a quantitative experimental design with a pre-test–post-test control group, the research involved forty first-grade senior students at an Islamic educational institution in Indonesia. Participants were randomly assigned to an experimental group receiving Duolingo-based vocabulary instruction and a control group taught through conventional classroom methods. Data were collected using validated vocabulary tests and supported by classroom observations and teacher field notes for triangulation. The findings reveal that students in the experimental group achieved significantly higher vocabulary gains than those in the control group, indicating that Duolingo-based learning had a strong and positive impact on Arabic vocabulary acquisition. These results suggest that gamified mobile-assisted language learning can effectively address persistent lexical challenges in Arabic education, particularly in contexts where exposure to the language is limited. The study contributes to the growing body of research on digital language pedagogy by positioning vocabulary acquisition as a central learning outcome and highlighting the pedagogical potential of Duolingo within Islamic educational settings.

Keywords: *Arabic Vocabulary Acquisition, Duolingo, Mobile-Assisted Language Learning, Gamified Learning*

Introduction

Vocabulary acquisition constitutes a foundational component in second and foreign language learning, as lexical knowledge underpins learners' ability to process meaning, construct sentences, and engage in higher-order language skills (Hanifansyah & Mahmudah, 2024; Mahmudah, 2025; Solehudin & Arisandi, 2024; Solehudin & Nur Hanifansyah, 2024). In Arabic language education, particularly within Islamic educational contexts, vocabulary mastery is not merely a linguistic goal but a prerequisite for accessing religious texts, classical scholarship, and contemporary Islamic knowledge (Hanifansyah et al., 2025). Despite its centrality, Arabic vocabulary acquisition remains a persistent challenge for learners in non-

Arab environments, where limited exposure, traditional instructional practices, and constrained learning time often hinder lexical development.

In many Islamic educational institutions, Arabic instruction continues to rely heavily on conventional teacher-centered approaches, rote memorization, and textbook-based learning (Arisandi & Habib, 2025; Habib et al., 2025; Masnun et al., 2025; Muhamad Solehudin et al., 2024). While these methods play an important role in preserving linguistic accuracy and tradition, they frequently fail to address learners' motivational needs and the demands of contemporary digital-native students. As a result, students often demonstrate limited vocabulary retention, low engagement, and slow lexical growth, which collectively weaken overall language proficiency. This condition has generated growing concern among educators regarding the effectiveness of existing pedagogical strategies for Arabic vocabulary instruction.

Recent advances in educational technology have introduced mobile-assisted language learning (MALL) as a promising alternative for enhancing vocabulary acquisition (Al-Abri et al., 2025; Çelik, 2025; Kessler et al., 2025; Shahipanah et al., 2025). Digital applications, particularly those incorporating gamification, adaptive feedback, and repetitive exposure, have been shown to facilitate vocabulary learning by increasing learner engagement and promoting autonomous practice. Among these applications, Duolingo has gained global recognition for its game-based design and structured vocabulary training. However, while Duolingo has been widely studied in the context of English and other major world languages, empirical research examining its effectiveness for Arabic vocabulary acquisition, especially within Islamic educational contexts, remains limited.

Previous studies have widely documented the role of mobile-assisted and AI-based technologies in language learning. Shortt et al. (2023), through a systematic review of Duolingo research, revealed that most existing studies emphasized app design, gamification, and performance-based outcomes, with a strong preference for English and Western contexts, leaving Arabic language learning relatively underexplored. Similarly, Ebadi and Amini (2024) demonstrated that AI-driven chatbots significantly enhanced learner motivation through social presence and human-likeness, although their focus remained on affective variables rather than linguistic outcomes such as vocabulary acquisition. These studies collectively highlight the pedagogical potential of AI and gamified applications, while also indicating a lack of empirical attention to lexical development as a primary learning objective.

In Arabic language education, several studies have begun to explore the use of Duolingo, yet vocabulary acquisition has often been treated as a secondary outcome. Ritonga et al. (2022) examined Duolingo as a platform for developing Arabic speaking skills in adult education, while Maghfurin et al. (2025) reported significant improvements in phonology, morphology, and syntax through Duolingo

and Memrise. More recently, Usof et al. (2025) identified both the effectiveness of Duolingo in supporting Arabic language learning and the persistent difficulty learners face in retaining vocabulary. Despite these contributions, empirical research that positions Arabic vocabulary acquisition as the central focus, particularly within Islamic educational contexts, remains limited—thus underscoring the need for the present study.

Recent developments in mobile-assisted language learning and artificial intelligence-enhanced education indicate a growing reliance on gamified digital applications to support language acquisition. Duolingo, as one of the most widely used platforms, has been extensively examined in relation to its design features, gamification mechanisms, and motivational affordances. Existing research generally emphasizes learner engagement, usability, and affective outcomes, highlighting the capacity of game-based learning environments to sustain interest and encourage repeated exposure to linguistic input. However, much of this body of work prioritizes technological design and learner perception over specific linguistic outcomes.

In Arabic language education, the use of mobile and AI-driven applications has gradually gained scholarly attention. Empirical studies suggest that such applications contribute positively to the development of various linguistic competencies, including pronunciation accuracy, grammatical awareness, and general language performance. Nevertheless, vocabulary learning is often treated as an embedded or secondary component within broader skill development rather than as a primary instructional target. Moreover, research in faith-based or Islamic educational contexts remains limited, despite the central role of Arabic vocabulary in enabling learners to access religious texts and knowledge. As a result, the current state of the art reflects a need to move beyond general evaluations of digital tools toward more focused investigations that position Arabic vocabulary acquisition as a core learning outcome within context-specific educational environments.

Despite the expanding body of research on Duolingo and AI-based language learning, several critical gaps remain. First, most existing studies treat vocabulary as a subsidiary component embedded within broader language skills, rather than as a primary and measurable learning outcome. Second, empirical investigations specifically targeting Arabic vocabulary acquisition through Duolingo are still scarce, particularly those employing experimental designs that allow for causal inference. Third, the majority of prior research has been conducted in general or secular educational settings, leaving Islamic educational contexts underrepresented, despite the central role of Arabic vocabulary in accessing religious and educational texts. Consequently, there is a clear need for focused empirical research that examines Duolingo-based Arabic vocabulary acquisition as a central construct within Islamic educational environments. The present study seeks to address these gaps by providing quantitative evidence on the effectiveness

of Duolingo in fostering Arabic vocabulary acquisition among learners in an Islamic educational context.

This study is guided by the following research questions: To what extent does Duolingo-based instruction enhance Arabic vocabulary acquisition among students in Islamic educational contexts? Is there a statistically significant difference in vocabulary acquisition between students taught using Duolingo and those taught through conventional methods?

The scope of this study is limited to Arabic vocabulary acquisition among secondary-level students in an Islamic educational setting. The research focuses on receptive and productive vocabulary measured through pre-test and post-test instruments within a controlled experimental design. This study does not examine other language skills such as speaking, listening, or writing, nor does it investigate long-term vocabulary retention beyond the research period. Additionally, the findings are context-specific and may not be directly generalizable to different educational levels or non-Islamic institutions.

This study offers several significant contributions. Theoretically, it strengthens the body of research on Arabic vocabulary acquisition by positioning vocabulary as an independent and central construct rather than a subsidiary skill. Pedagogically, it provides empirical support for the integration of gamified digital applications into Arabic instruction within Islamic educational contexts. Practically, the findings offer actionable insights for educators and curriculum designers seeking effective, learner-centered strategies to improve Arabic vocabulary mastery. By addressing a clear empirical gap, this research contributes to ongoing discussions on innovation, technology adoption, and vocabulary-focused pedagogy in Arabic language education.

Method

This study adopted a quantitative experimental approach using a pre-test-post-test control group design to examine the effectiveness of Duolingo-based instruction in enhancing Arabic vocabulary acquisition (Creswell & Creswell, 2020). The research was conducted at an Islamic educational institution in Indonesia, where Arabic is taught as a foreign language and serves both academic and religious purposes. The participants consisted of forty first-grade senior students with comparable educational backgrounds, who were randomly assigned to an experimental group ($n = 20$) and a control group ($n = 20$). Prior to data collection, ethical approval for the study was obtained from the institutional research authority, and informed consent was secured from all participants, ensuring voluntary participation, confidentiality of data, and the right to withdraw at any stage of the research. Both groups completed a vocabulary pre-test to measure baseline lexical knowledge. The experimental group subsequently received vocabulary instruction

through the Duolingo mobile application, which emphasized repeated lexical exposure, pronunciation support, and contextualized practice through gamified activities, while the control group was taught the same vocabulary items using conventional classroom-based instruction without digital applications. The treatment was implemented over four instructional sessions within the regular instructional schedule. Following the intervention, a post-test identical in format to the pre-test was administered to both groups to measure vocabulary gains. To strengthen the credibility and validity of the findings, methodological triangulation was applied by combining quantitative test scores with classroom observations and teacher field notes, which were used to verify the consistency of students' engagement and learning behaviours during the intervention (Abdulloh et al., 2022; Campbell et al., 2020). The quantitative data were analyzed using descriptive statistics and inferential analysis through a t-test at the 5% and 1% significance levels to determine whether the observed differences in Arabic vocabulary acquisition between the experimental and control groups were statistically significant.

Result and Discussion

The results of this study indicate a substantial improvement in Arabic vocabulary acquisition among students who received Duolingo-based instruction. Prior to the intervention, the pre-test results showed that both the experimental and control groups had relatively comparable levels of vocabulary knowledge, suggesting that the two groups started from a similar baseline. This initial equivalence supports the validity of subsequent comparisons between the groups.

Following the instructional treatment, the post-test results revealed a marked increase in vocabulary scores for the experimental group. The mean post-test score of the experimental group reached 86, which falls within the "very good" proficiency category, indicating a significant gain in Arabic vocabulary acquisition after the use of Duolingo. In contrast, the control group, which received conventional instruction without digital support, achieved a mean post-test score of 68, categorized as "fair." Although the control group demonstrated some improvement, the magnitude of gain was notably lower than that observed in the experimental group.

Inferential statistical analysis further confirmed these findings. The paired-sample t-test conducted on the experimental group showed a t-value of 6.83, which exceeded the critical t-values at both the 5% and 1% significance levels. This result indicates a statistically significant difference between the pre-test and post-test scores, demonstrating that Duolingo-based instruction had a strong effect on students' Arabic vocabulary acquisition. Meanwhile, the control group produced a t-value of 4.40, reflecting a modest improvement that remained inferior to the gains achieved by the experimental group.

A comparative analysis of post-test scores between the two groups also revealed a statistically significant difference favoring the experimental group. The higher mean score and stronger t-value observed in the experimental group suggest that the integration of Duolingo contributed more effectively to vocabulary acquisition than traditional instructional methods. These results collectively demonstrate that Duolingo-based learning had a positive and statistically significant impact on Arabic vocabulary acquisition within the investigated Islamic educational context.

Table 1. Descriptive Statistics of Arabic Vocabulary Test Scores

Group	N	Pre-Test Mean	Post-Test Mean	Gain
Experimental (Duolingo)	20	64.2	86.0	+21.8
Control (Conventional)	20	62.5	68.0	+5.5

Note. Scores range from 0–100. Vocabulary gain represents the difference between post-test and pre-test mean scores.

Table 2. Paired-Sample t-Test Results for Vocabulary Acquisition

Group	Mean Difference	SD	SE	t-value	df	Sig. (p)
Experimental	22.81	7.19	3.34	6.83	19	< .01
Control	12.00	5.86	2.73	4.40	19	< .01

Note. The critical t-values are 2.09 (p < .05) and 2.86 (p < .01).

Table 3. Independent t-Test of Post-Test Scores Between Groups

Group	N	Mean	SD
Experimental (Duolingo)	20	85.5	7.1
Control (Conventional)	20	68.5	6.4
t-value	df	Sig. (p)	
3.24	38	< .01	

As shown in Tables 1–3, students in the experimental group demonstrated substantially higher gains in Arabic vocabulary acquisition than those in the control group. While both groups showed improvement from pre-test to post-test, the experimental group achieved a markedly larger mean gain, indicating a stronger instructional effect. The statistically significant t-values further confirm that Duolingo-based instruction resulted in superior vocabulary outcomes compared to conventional teaching methods.

The findings of this study demonstrate that Duolingo-based instruction significantly enhances Arabic vocabulary acquisition among students in Islamic educational contexts. The substantial vocabulary gains observed in the experimental group confirm that structured exposure to lexical items through gamified mobile applications can outperform conventional classroom-based instruction. This result aligns with broader research in mobile-assisted language learning, which

emphasizes the effectiveness of repetitive, interactive, and learner-centered digital environments in supporting vocabulary development, particularly for foreign language learners.

These findings are consistent with the conclusions drawn in the systematic review of Duolingo literature conducted by Shortt et al. (2023), which highlighted the strong pedagogical potential of gamification and mobile platforms in sustaining learner engagement and promoting repeated interaction with language input. However, while earlier studies predominantly focused on application design and motivational outcomes, the present study extends this line of research by providing empirical evidence that Duolingo's design features translate into measurable gains in Arabic vocabulary acquisition, an area that has been underrepresented in prior research.

The results also complement research on artificial intelligence-based language learning that emphasizes affective and motivational dimensions. For example, Ebadi and Amini (2024) demonstrated that AI-driven chatbots enhance learner motivation through social presence and perceived human-likeness. Although their study did not directly assess vocabulary acquisition, the motivational mechanisms they identified may help explain the vocabulary gains observed in the present study. Increased learner engagement and reduced anxiety, fostered by interactive and game-like environments, likely contributed to students' sustained practice and improved lexical retention when using Duolingo.

In the context of Arabic language education, the present findings partially corroborate earlier empirical studies that examined Duolingo's role in developing Arabic language skills. Ritonga et al. (2022) reported that Duolingo is effective for supporting Arabic speaking skills among adult learners, while Maghfurin et al. (2025) demonstrated significant improvements in phonological, morphological, and syntactic competencies through Duolingo and Memrise. Unlike these studies, which positioned vocabulary as a supporting element within broader linguistic competencies, the current study explicitly foregrounds vocabulary acquisition as the primary learning outcome. This distinction is crucial, as lexical knowledge forms the foundation upon which other language skills are built, particularly in contexts where learners have limited exposure to Arabic outside the classroom.

Moreover, the findings directly address concerns raised by Usof et al. (2025), who identified vocabulary retention as one of the main challenges faced by learners using AI-based applications for Arabic language learning. The significant vocabulary gains observed in this study suggest that, when Duolingo is integrated systematically and supported by instructional guidance, it can mitigate lexical retention difficulties rather than exacerbate them. This indicates that the effectiveness of AI-based applications depends not only on the technology itself but also on pedagogical integration within the learning environment.

Taken together, the results of this study extend the existing literature by empirically validating Duolingo as an effective tool for Arabic vocabulary acquisition within Islamic educational settings. By shifting the analytical focus from general language performance and affective outcomes to vocabulary as an independent construct, this research contributes to a more nuanced understanding of how mobile-assisted and AI-supported learning can address core linguistic challenges. The findings underscore the importance of vocabulary-focused digital pedagogy as a strategic response to the lexical limitations commonly observed among Arabic learners in non-Arab and faith-based educational contexts.

Conclusion

This study set out to examine the effectiveness of Duolingo-based instruction in enhancing Arabic vocabulary acquisition within Islamic educational contexts. The findings demonstrate that students who engaged with Duolingo achieved significantly higher vocabulary gains than those who received conventional instruction, confirming that gamified mobile-assisted learning can serve as an effective pedagogical approach for addressing persistent lexical challenges in Arabic language education. By positioning vocabulary acquisition as the central learning outcome, this study contributes empirical evidence to an area that has remained underexplored in prior Duolingo and AI-assisted language learning research.

Theoretically, this research advances the field of Arabic language education by reinforcing the role of vocabulary as a foundational construct rather than a subsidiary component of broader language skills. The results suggest that structured digital repetition, multimodal input, and learner-controlled pacing core features of Duolingo support more effective lexical acquisition among non-native learners. Pedagogically, the study highlights the importance of integrating mobile applications within guided instructional frameworks, particularly in Islamic educational settings where Arabic functions as both an academic and religious language. When implemented systematically, Duolingo can complement traditional teaching methods and help overcome limitations associated with time, exposure, and learner motivation.

Despite these contributions, the study has several limitations. The research was conducted with a relatively small sample size over a short intervention period and focused exclusively on short-term vocabulary gains. Future research should therefore investigate long-term retention, involve larger and more diverse participant groups, and explore how Duolingo-based vocabulary learning interacts with other language skills. Further studies may also consider comparative designs involving multiple digital platforms or qualitative analyses of learners' cognitive and affective experiences. Overall, this study underscores the potential of vocabulary-focused digital pedagogy to enrich Arabic language learning and provides a

foundation for future research on mobile-assisted instruction in Islamic educational contexts.

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