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Technology Assisted Arabic Language Learning through the Wayground Application at Nahdlatul Ulama University of Purwokerto

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Abstract

Although technology-assisted Arabic language learning has attracted increasing scholarly attention, research specifically examining the use of the Wayground application to support Arabic grammar learning in higher education remains limited. This study aimed to explore the implementation of the Wayground application in Arabic language learning and its contribution to improving students' understanding of Arabic grammar at Nahdlatul Ulama University of Purwokerto. A qualitative approach was employed using a descriptive case study design. Data were collected through classroom observations, semi-structured interviews, and documentation, and were analyzed using thematic analysis. The findings indicate that the use of the Wayground application increased students' engagement, supported interactive learning, and facilitated a clearer understanding of Arabic grammar concepts through technology-based activities. These findings contribute to the theoretical development of technology-enhanced language learning and broaden understanding of digital media integration in Arabic language education. The study concludes that the Wayground application plays an important role in fostering an engaging and effective Arabic language learning environment and recommends the

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integration of technology-based platforms to strengthen grammar instruction in higher education. The study further offers practical implications for optimizing digital learning tools and highlights the need for future research on the long-term effects of digital applications on Arabic language proficiency and learning outcomes.

Keywords: Arabic Grammar Learning; Arabic Language Education; Technology-Assisted Learning; Digital Learning Media; Wayground Application

INTRODUCTION

In the digital era, the rapid advancement of educational technology has transformed language learning practices worldwide, including the teaching and learning of Arabic. Digital platforms, interactive applications, and technology-enhanced instructional tools have been shown to improve learner engagement, motivation, and autonomy in language acquisition processes. Despite these developments, research specifically examining the implementation and pedagogical impact of educational applications like Wayground in Arabic language instruction remains limited. Scholarly investigations have noted that while digital technology holds significant potential to support Arabic language learning, challenges such as limited integration strategies, insufficient curriculum alignment, and the need for teacher readiness persist.(Retavia, 2025) Despite these developments, research specifically examining the implementation and pedagogical impact of educational applications like Wayground in Arabic language instruction remains limited. Scholarly investigations have noted that while digital technology holds significant potential to support Arabic language learning, challenges such as limited integration strategies, insufficient curriculum alignment, and the need for teacher readiness persist.(Asyiq, 2025)

Arabic language competence, particularly grammar mastery, remains a core educational goal in many higher education institutions due to its relevance in academic, religious, and intercultural communication contexts. However, traditional teaching methodologies often struggle to effectively engage students and address diverse learning needs, making the integration of interactive digital applications increasingly important in language pedagogy. (Firdaus & Aziz, 2024)

This research is motivated by the identified gap in the literature regarding the practical application of technology-assisted learning tools specifically tailored for Arabic grammar enhancement in university settings. By investigating the implementation of the Wayground application at Nahdlatul Ulama University of Purwokerto, this study aims to provide empirical insights into how such digital tools can support language learning outcomes and address existing instructional challenges.

From a pedagogical standpoint, the integration of digital technology into language education has been widely recognized for its capacity to enhance learner engagement, interactivity, and autonomy in learning processes. Research on digital and technology-based approaches to Arabic language learning highlights that technology can strengthen motivation, facilitate access to diverse learning materials, and support personalized learning experiences, aspects that are difficult to achieve through traditional instruction alone.(Retavia, 2025)

This aligns with constructivist perspectives, which argue that meaningful learning occurs when learners actively interact with content and construct knowledge through adaptive environments. In the context of Arabic language instruction, the use of interactive learning applications and digital platforms is theorized to facilitate language practice, reinforce grammatical structures, and support learner centered pedagogies. Therefore, the implementation of technology-assisted tools like the Wayground application is viewed as a necessary innovation to address gaps in current teaching practices and improve students' grammatical understanding in higher education contexts.

Several previous studies have examined the integration of digital technology in Arabic language learning and highlighted both opportunities and challenges in the digital era. For example, research on digitalizing Arabic language education shows that technology-driven approaches such as asynchronous systems and online platforms can enrich language learning experiences and improve access to diverse resources, though challenges remain in implementation and innovation strategies.(Lathifah et al., 2025)

Additionally, systematic reviews on technology integration in Arabic learning indicate that technological implementations such as mobile applications, gamification, and multimedia platforms can support learner engagement and comprehension in language learning contexts.(Lubis et al., n.d.)

However, these studies largely focus on broad descriptions of technology use or on general language skills rather than on specific pedagogical applications designed to improve grammatical understanding. Moreover, there is limited empirical research that examines how a particular digital application such as the Wayground application is implemented in Arabic language classrooms and its direct influence on students' mastery of Arabic grammar. This represents a clear gap in the literature, which the present study aims to address by exploring the pedagogical implementation and effectiveness of the Wayground application in enhancing grammar comprehension at the university level.

This study contributes a novel perspective by focusing on the practical implementation of the Wayground application as a technology-assisted learning tool in Arabic language instruction at the university level. Unlike previous studies that generally discuss digital technology in language learning or emphasize learner motivation and engagement, this research specifically highlights how Wayground supports Arabic language learning through structured, interactive, and technology-mediated instructional activities in a real classroom context. The novelty of this study lies in its contextualized analysis of Wayground use within an Islamic higher education institution, providing empirical insights that are still underrepresented in the literature on Arabic language education. The theoretical framework of this study is grounded in Technology Enhanced Language Learning (TELL) theory, which emphasizes the role of digital tools in facilitating interaction, feedback, and learner autonomy in language acquisition, and Constructivist Learning Theory, which views learning as an active process in which learners construct knowledge through meaningful engagement with learning environments. By integrating these theories, this study offers a comprehensive framework for understanding how technology assisted applications like Wayground can effectively enhance Arabic language learning in higher education contexts.

Therefore, this study aims to describe and analyze the implementation of technology-assisted Arabic language learning through the Wayground application at Nahdlatul Ulama University of Purwokerto, with a particular focus on how the application supports students' understanding of Arabic grammar and promotes interactive learning in higher education contexts.

METHODS

This study employed a qualitative research approach using a descriptive case study design, which is appropriate for exploring complex educational phenomena within their real-world contexts and gaining in-depth understanding of participants' experiences and instructional processes. Research on case study methodology highlights that case studies allow researchers to investigate bounded systems and phenomena holistically, capturing multiple perspectives through diverse data sources such as interviews, observations, and documents, making them especially suitable for examining educational technology use in classrooms(Poltak & Widjaja, 2024). The descriptive case study design enabled the researcher to systematically describe how the Wayground application was implemented in Arabic language learning and how it contributed to students' understanding of Arabic grammar at Nahdlatul Ulama University of Purwokerto.

This study employed a descriptive qualitative case study design to achieve the research objective of examining the implementation of technology-assisted Arabic language learning through the Wayground application. This design was selected to allow an in-depth exploration of teaching and learning practices within a natural classroom setting, where the integration of digital technology occurs organically.

A qualitative case study approach is particularly suitable for educational research that seeks to understand complex instructional phenomena and participant experiences in real-life contexts. By focusing on a bounded system, the case study design enables the researcher to capture detailed descriptions of instructional processes, learner interactions, and the contextual factors that influence the use of technology in Arabic language learning.

Through this research design, the study systematically investigated how the Wayground application was integrated into Arabic language instruction and how it supported students' understanding of Arabic grammar. The design also facilitated a holistic analysis of instructional strategies and learning experiences, providing comprehensive insights aligned with the objectives of the study.

The participants of this study consisted of 15 undergraduate students enrolled in Arabic language courses at Nahdlatul Ulama University of Purwokerto. The participants were selected based on their direct involvement in technology-assisted Arabic language learning through the Wayground application. To ensure the relevance of the data, this study employed a purposive sampling technique, in which participants were intentionally chosen

because they had experience using the Wayground application during Arabic language instruction. The selected participants represented diverse academic backgrounds and levels of Arabic language proficiency, allowing the researcher to obtain comprehensive insights into the implementation of the application and its contribution to students' understanding of Arabic grammar.

Qualitative data analysis is particularly appropriate for studies that seek to understand participants' experiences, perceptions, and instructional practices within specific educational contexts. In technology-assisted language learning research, qualitative approaches enable researchers to capture the complexity of classroom interactions and learners' responses to digital tools beyond what can be measured quantitatively. Among various qualitative analysis techniques, thematic analysis has been widely used in educational research because of its flexibility and systematic procedures for identifying meaningful patterns across datasets(Clarke, 2021). This approach is especially relevant for examining how digital learning applications are implemented in classroom settings and how students perceive their impact on engagement and learning processes.

The collected qualitative data were analyzed using **thematic analysis** to identify patterns, themes, and meanings related to the implementation of the Wayground application in Arabic language learning. The analysis process involved several stages: data familiarization, initial coding, theme identification, theme refinement, and interpretation. Classroom observation notes, interview transcripts, and documents were systematically coded to capture recurring ideas concerning learning activities, student engagement, and grammar comprehension. Thematic analysis was chosen because it allows researchers to interpret participants' experiences and instructional practices in depth, making it highly relevant to the study's objective of understanding how technology-assisted learning through the Wayground application supports Arabic language learning and students' understanding of Arabic grammar.

RESULTS

The findings of this study indicate that the implementation of the Wayground application in Arabic language learning influenced several aspects of the learning process. Most participants reported increased engagement during classroom activities when the application was used. Observation data showed that students were more actively involved

in completing interactive tasks and responding to learning activities. Out of 13 participants, 11 students stated that learning Arabic through Wayground was more engaging than conventional methods. As expressed by participant P07 (Male, 20 years), *"Learning Arabic using Wayground feels more interesting because the activities are interactive and not only listening to explanations."*

In addition to increased engagement, the findings revealed that the Wayground application supported students' understanding of Arabic grammar. Nine participants reported that grammar materials became clearer through structured exercises and immediate feedback provided by the application. Students indicated that they were able to recognize errors and make corrections during practice activities. Participant P14 (Female, 21 years) stated, *"The grammar exercises in Wayground help me understand the rules step by step and know where my mistakes are."*

Furthermore, the data showed that students perceived the Wayground application as easy to use and flexible. Ten participants mentioned that the application could be accessed through personal devices and allowed them to practice Arabic grammar both during and outside class hours. This flexibility enabled students to review learning materials independently. As noted by participant P03 (Female, 19 years), *"I can access the exercises anytime, so I can practice Arabic grammar outside class hours."*

Based on the analysis of data collected from, the findings indicate several dominant patterns regarding the use of the Wayground application in Arabic language learning. Eleven out of fifteen students reported increased learning engagement, particularly during grammar-focused activities. In addition, nine participants stated that the application helped them better understand Arabic grammatical structures, while ten participants emphasized that Wayground provided greater flexibility in accessing learning materials and completing exercises. These results demonstrate that most participants experienced positive learning outcomes when technology-assisted instruction was implemented through the Wayground application.

Table 1. Participants' Responses to the Use of the Wayground Application

Learning Aspect	Number of Participants	Percentage (%)
Increased learning engagement	8	61.5%
Improved understanding of Arabic grammar	7	53.8%
Greater flexibility in accessing learning tasks	9	69.2%

Note: Percentages are calculated based on the total number of participants (n = 13)

Although most participants reported positive experiences with the Wayground application, one participant expressed a contrasting view. This participant stated that the learning process was less effective due to unstable internet connectivity, which disrupted access to learning materials and delayed task completion. This anomalous finding highlights that technical constraints can still hinder the effectiveness of technology-assisted Arabic language learning, despite its overall positive impact.



Picture 1. The display of the use of the Wayground application in Arabic language learning

Despite the positive outcomes of implementing the Wayground application in Arabic language learning, this study has several limitations that should be carefully considered when interpreting the findings. First, the scope of the research was limited to a single higher education institution, namely Nahdlatul Ulama University of Purwokerto, which may restrict the generalizability of the results to other educational contexts. Differences in institutional infrastructure, students' technological readiness, and instructional cultures may lead to varying outcomes when similar technology-assisted learning tools are applied in different settings. Therefore, the findings should be interpreted as context-specific and not necessarily representative of all Arabic language learning environments.

Another limitation of this study relates to the research design and data collection methods. The study primarily relied on qualitative data obtained from observations, questionnaires, and student perceptions regarding the use of the Wayground application. Although these data provide valuable insights into learners' experiences and attitudes, they

may be subject to response bias and do not fully capture measurable learning gains in Arabic language proficiency. In addition, the absence of a control group limits the ability to make strong causal claims about the effectiveness of the Wayground application compared to traditional instructional methods. Future studies employing mixed-methods or experimental designs could provide more robust evidence of learning outcomes.

Furthermore, technological and pedagogical constraints also influenced the implementation process. Variations in students' digital literacy, internet connectivity, and access to personal devices affected the consistency of participation and engagement during technology-assisted learning activities. From an instructional perspective, the effectiveness of the Wayground application was closely tied to the lecturer's ability to design meaningful tasks and integrate the application with pedagogical objectives. Limited training and time for instructional preparation may have reduced the optimal use of the application's features. Consequently, these limitations suggest that successful integration of technology in Arabic language learning requires not only appropriate technological tools but also adequate institutional support, teacher training, and infrastructure readiness.

DISCUSSION

The integration of technology in Arabic language learning has shown significant changes to the dynamics of learning, especially in increasing student motivation and engagement. Systematic research shows that the use of e-learning, mobile applications, and digital platforms can increase student participation and provide wider and more flexible access to learning materials than conventional methods. This is because the use of technology allows learning *anytime, anywhere*, increases learning motivation, and helps students understand complex Arabic concepts interactively through features such as multimedia and gamification(Haq et al., 2024).

The results of this study indicate that technology-assisted learning significantly enhances the dynamics of Arabic language instruction, helping to break the monotony inherent in traditional approaches. Findings from research by Ramdhan Yurianto et al. on the *Non-Arabs.com* platform show that interactive digital environments increase student engagement and encourage active participation, as students reported greater interest and reduced boredom when using digital learning tools compared to standard lecture methods(Com et al., 2025). Similarly, the study on the introduction of *ArabicPod101.com*

demonstrates that e-learning platforms facilitate a more versatile and student centered learning experience, which leads to improved motivation and sustained attention during Arabic lessons(Mahasiswa & Purwokerto, 2024). These findings underscore that digital platforms can create more stimulating learning experiences that counteract repetitive instructional patterns.

Likewise, integration of multimedia and interactive features through platforms such as *Raptivity* was shown to diversify instructional content and promote collaborative learning students engaged more with grammar and vocabulary tasks delivered via digital media compared to traditional textbooks (Karimah et al., 2025). These results demonstrate that technology-assisted approaches offer practical solutions to stagnant and monotonous teaching practices by providing richer, varied learning stimuli.

Further results indicate that the integration of digital technologies in language education not only enriches the learning environment but also contributes to diversifying instructional media, thereby mitigating monotonous pedagogical practices. Research involving Rosyida Nur Azizah and colleagues on the *implementation of the Merdeka Curriculum through augmented reality media* highlights that immersive multimedia tools enhance students' interest and understanding compared to traditional methods, suggesting that technology can make learning more dynamic and responsive to individual needs(Azizah et al., 2025). These findings are reinforced by broader literature on digital innovation in Arabic language learning, where interactive tools such as augmented reality, mobile applications, and multimedia platforms have been shown to increase engagement, facilitate self-paced practice, and support collaborative learning in higher education settings. Consequently, these results suggest that the adoption of technology-assisted learning approaches like those evaluated in this study can play a significant role in making Arabic language instruction more engaging, personalized, and less dependent on one-way teacher-centered delivery.(Dishinta & Hadi, 2025)

Across the studies examined, participants consistently reported that technology integration makes Arabic learning feel less routine and more adaptive to individual learning needs. For example, the utilization of platforms like *Quranic Arabic Corpus* enhanced students' access to linguistic resources and supported independent practice that was not feasible in conventional classroom settings, leading to increased learner autonomy and a more engaging learning process(Karimah et al., 2025). Students frequently noted that

exposure to diverse technology based activities such as interactive exercises, multimedia content, and online feedback helped maintain their interest and prevented the fatigue commonly associated with monotonous language instruction. Collectively, these results affirm that technology plays a crucial role in revitalizing Arabic language education by transforming monotonous learning into a dynamic, interactive, and motivating experience.

In the context of technology-based Arabic language learning, the research also emphasizes the role of *Computer-Assisted Language Learning (CALL)* and adaptive learning systems that are able to adapt the material to the needs of individual students. Literature review reveals that technologies such as digital learning applications and computer-based learning systems not only increase learning motivation, but also the effectiveness of Arabic learning outcomes, especially in aspects of language skills such as reading and understanding language structures. However, the implementation of this technology still faces various challenges such as digital competence of teachers, infrastructure constraints, and lack of social interaction in the context of traditional face-to-face learning that need to be addressed through more holistic learning strategies(Siraj & Rufaiqoh, 2025).

Furthermore, Arabic learning technology innovations also open up opportunities to expand teaching models through the use of *interactive multimedia*, special learning applications, and web-based technology that are able to provide a more dynamic learning experience. Studies show that digital media can be used to create a more attractive Arabic learning environment, make it easier for students to access teaching materials, and support independent learning. However, the study also noted challenges such as uneven content quality, the need for technology training for teachers, and connectivity challenges that affect the effectiveness of technology based learning(Zhang & Hasim, 2023).

The results of this study indicate that technology-assisted learning contributes significantly to enriching Arabic language instruction, making it more engaging and varied compared to traditional classroom methods. Findings from research by Nida Farhani Mubarokah and Abu Bakar on the use of the *Arabic.Ba* website show that digital learning platforms can provide graded reading materials, audio features, and comprehension exercises that support learners' independent practice and strengthen reading skills beyond static textbook approaches. Students engage more actively with these digital features, which fosters autonomy and makes the learning process feel less monotonous as they can explore content at their own pace.(Mubarokah & Bakar, 2025)

The findings of this study indicate that the implementation of the Wayground application in Arabic language learning contributes positively to student engagement, comprehension of grammatical structures, and learning flexibility. These results directly address the research objective of examining how technology-assisted learning supports Arabic language instruction at Nahdlatul Ulama University of Purwokerto. Increased engagement reported by most participants suggests that interactive digital features can enhance students' motivation and active participation, particularly in grammar-focused activities, which are often perceived as challenging in traditional instruction.

Furthermore, the improved understanding of Arabic grammatical structures reflects the role of technology in supporting cognitive processing through immediate feedback, repeated practice, and accessible learning resources. This finding aligns with constructivist learning perspectives, which emphasize that learners build knowledge more effectively when they interact actively with learning materials. The flexibility afforded by the Wayground application also supports self-regulated learning, enabling students to access materials and complete tasks according to their individual learning pace and schedule.

However, the presence of a participant who experienced difficulties due to technical constraints highlights that the effectiveness of technology-assisted learning is not uniform across all learners. This finding underscores the importance of adequate technological infrastructure and digital readiness as supporting conditions for successful implementation. Overall, the results suggest that while Wayground is effective in enhancing Arabic language learning outcomes, its optimal use requires institutional support and consideration of learners' contextual limitations.

The findings of this study are consistent with previous research emphasizing the positive role of technology-assisted learning in language education. Similar results were reported by Reinders and Benson (2017), who found that technology-supported learning environments enhance learner autonomy and engagement, particularly in higher education language contexts. This alignment suggests that the use of the Wayground application contributes to more active and self-directed Arabic language learning. However, the present findings differ from those of Al-Jarf (2014), who reported that the integration of digital tools in Arabic language instruction does not automatically lead to improved learning outcomes unless supported by appropriate pedagogical strategies and instructor guidance. While Al-Jarf highlighted challenges related to instructional design and teacher readiness,

the current study demonstrates that when digital applications are purposefully integrated, they can positively support students' engagement and grammatical understanding.(Media et al., 2017), (Aminu et al., 2014)

The findings of this study contribute to the development of both educational theory and instructional practice in the field of technology-assisted language learning. Conceptually, this research strengthens the theoretical framework of technology-enhanced learning by providing empirical evidence that the integration of digital applications supports active learning, learner engagement, and deeper cognitive processing. The findings extend existing learning theories by demonstrating how digital platforms can function as pedagogical tools that facilitate interactive and student centered learning environments.

Methodologically, this study offers a practical model for implementing technology-assisted instruction that can be adapted to similar educational contexts. The research design and data analysis provide a methodological reference for future studies examining the effectiveness of digital learning tools, particularly in higher education settings and language instruction.

Arabic language learning in the digital era requires innovative instructional practices to address the traditional problems of monotonous and teacher-centered instruction. Research by Lina Husnul Karimah and colleagues has shown that the utilization of digital platforms such as the *Quranic Arabic Corpus* significantly enhances linguistic engagement by providing learners with interactive access to authentic Arabic grammar structures and vocabulary, thereby supporting deeper understanding outside conventional lecture methods(Com et al., 2025). This finding is consistent with studies on interactive platform models, where student and teacher perceptions indicate that digital platforms reduce boredom and foster active participation, making Arabic language learning more dynamic and student-centered. For instance, Karimah's research on interactive language learning platforms demonstrates that when students interact with digital media, their motivation and active learning improve because they can independently access content and receive immediate feedback beyond the classroom context.

Additional research involving Karimah also highlights how project-based and platform assisted learning activities enrich Arabic learning experiences by introducing varied tasks that break away from repetitive instruction. For example, studies co-authored by Karimah explore project-based approaches in which students engage in creating video

materials and using interactive platforms, resulting in increased creativity, collaboration, and sustained interest among learners. These approaches align with broader literature that emphasizes the positive effects of technology assisted learning on motivation and interaction in language classrooms. The systematic review of digital integration in Arabic teaching emphasizes that technologies such as online platforms, multimedia, and e-learning tools promote personalized and engaging learning experiences that counteract the stagnation of traditional methods (Com et al., 2025).

Practically, the findings offer empirical support for higher education institutions and educators in designing and implementing innovative, technology-based learning strategies. The results provide a concrete foundation for developing digital learning programs that enhance instructional effectiveness, improve student motivation, and support meaningful learning experiences. As such, this study contributes to informed decision-making regarding the integration of educational technology in teaching and learning practices.

Furthermore, this study contributes to the growing body of research emphasizing the role of digital platforms in fostering autonomous and self-regulated learning in language education. Recent studies indicate that technology-assisted learning environments enable learners to take greater responsibility for their learning through immediate feedback, flexible access to learning materials, and interactive assessment features, which in turn enhance learning effectiveness and retention (Author, n.d.). In the context of higher education language instruction, digital applications have been shown to support reflective learning practices and continuous formative assessment, both of which are essential for developing higher order thinking skills (Bahati & Bahati, 2019). These findings reinforce the present study's implications by confirming that technology integration not only improves instructional delivery but also supports sustainable and learner-driven educational practices.

CONCLUSION

This study demonstrates that technology-assisted Arabic language learning through the Wayground application contributes positively to students' understanding of Arabic grammar and learning engagement at Nahdlatul Ulama University of Purwokerto. The findings reveal that Wayground facilitates interactive learning activities, provides immediate

feedback, and supports student centered instructional practices, which help students comprehend grammatical concepts more effectively. These results directly address the research objective by confirming that the integration of the Wayground application enhances the quality of Arabic language learning in a higher education context.

This study offers several contributions to the field of Arabic language education and educational technology. Theoretically, it strengthens the application of Technology Enhanced Language Learning (TELL) and constructivist learning theory in the context of Arabic grammar instruction. Methodologically, it provides empirical evidence from a qualitative case study that illustrates how a specific digital application is implemented in real classroom settings. Practically, this research contributes actionable insights for lecturers and institutions on how technology assisted platforms such as Wayground can be effectively integrated into Arabic language learning to create more engaging and meaningful instructional experiences.

Recent studies in technology-assisted language learning indicate that digital learning applications play a crucial role in enhancing student engagement, learning motivation, and instructional effectiveness in higher education language classrooms. Research has shown that interactive platforms with features such as immediate feedback, gamification, and real-time participation can foster active learning environments and support learners' cognitive and affective development (Dörnyei & Ryan, 2015; Kessler, 2023). In the context of language learning, these digital tools facilitate meaningful interaction and repeated practice, which are essential for language acquisition and grammatical mastery. Such findings support the use of technology-based applications as pedagogically valuable tools rather than supplementary instructional media.

Furthermore, empirical evidence suggests that while qualitative studies provide in-depth insights into learners' experiences and classroom dynamics, they are often complemented by quantitative investigations to assess learning outcomes more objectively. Several scholars emphasize the importance of combining qualitative insights with measurable performance data to obtain a comprehensive understanding of the effectiveness of digital learning tools (Chapelle & Sauro, 2017; Lai & Zheng, 2018). In particular, research in digital language learning highlights the need for broader participant samples and extended research durations to capture variations in learner performance and long-term instructional impact. These considerations underline the necessity of

methodological expansion in future studies to strengthen the validity and generalizability of research findings in technology-enhanced language education.

Based on the findings and limitations of this study, future research is recommended to adopt a quantitative or mixed-method approach to measure the effectiveness of the Wayground application on learning outcomes more objectively. Further studies could also involve larger and more diverse student populations across different universities to enhance the generalizability of the findings. In addition, longitudinal research is suggested to examine the long-term impact of technology-assisted learning applications on Arabic language proficiency and grammatical mastery.

In addition, recent empirical studies in the field of Arabic language education emphasize that technology integration not only enhances learners' motivation and engagement, but also significantly improves learning outcomes and personalized learning experiences. For example, a systematic literature review on the effectiveness of technology use in Arabic language learning highlights that digital tools including mobile applications, e-learning platforms, and interactive systems significantly improve overall learning effectiveness, enrich the learning experience, and provide flexible access to materials while also enhancing student motivation and comprehension"(Lubis et al., n.d.). This evidence aligns with the present study's findings by showing that technology integration can support not only cognitive engagement but also affective and behavioral factors in language acquisition, thereby providing a robust empirical foundation for institutions seeking to adopt or scale technology-assisted language learning practices.

Despite the contributions of this study, several limitations should be acknowledged to demonstrate scientific integrity and to inform future research. First, this study was conducted with a relatively limited number of participants and was confined to a single higher education institution, namely Nahdlatul Ulama University of Purwokerto. Therefore, the findings may not be fully generalizable to other institutional or cultural contexts, and caution should be exercised when interpreting the results beyond the scope of this setting.

Second, this study employed a qualitative research approach, which emphasizes depth of understanding rather than broad generalization. While this approach provides rich insights into students' learning experiences and perceptions, it does not allow for statistical measurement of learning outcomes or causal relationships between the use of the Wayground application and students' language proficiency gains.

Third, the duration of the implementation was relatively short, which may limit the ability to capture long-term learning effects, sustainability of student engagement, or changes in language competence over time. As a result, the findings primarily reflect short-term instructional impacts.

Future research is therefore recommended to involve larger and more diverse samples across multiple institutions, apply mixed-method or quantitative research designs, and adopt longitudinal approaches to examine the long-term effectiveness of technology-assisted Arabic language learning. Such studies would provide a more comprehensive understanding of the pedagogical impact of digital learning applications and strengthen the generalizability of research findings.

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