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Research Article

TECHNOLOGY FOR INCLUSIVE ARABIC LANGUAGE EDUCATION: ADDRESSING THE NEEDS OF SPECIAL EDUCATION ARABIC LEARNERS

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Abstract

Inclusive education has gained increasing attention as a critical factor in ensuring all students, including those with special educational needs, have access to quality learning experiences. Arabic language education, in particular, presents unique challenges for special education learners due to its complex script, grammar, and phonology. Technology has been suggested as a solution to support these learners by providing tailored, adaptive learning experiences. This study investigates the role of technology in enhancing Arabic language learning for special education students. The research aims to identify how assistive technologies, such as text-to-speech tools, interactive apps, and gamified learning environments, can improve both student engagement and language proficiency. A mixed-methods approach was employed, including pre- and post-test assessments of language proficiency, a student engagement survey, and qualitative interviews with students and teachers. The findings indicate that the experimental group, which utilized technology-enhanced tools, showed significant improvements in language proficiency and higher levels of engagement compared to the control group using traditional methods. This study concludes that technology offers substantial benefits in creating more inclusive and effective Arabic language education environments for special education learners. The integration of adaptive learning technologies is essential for supporting students with disabilities and fostering their academic success.

Keywords: Arabic Language, Engagement, Inclusive Education, Special Education, Technology

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INTRODUCTION

Inclusive education has emerged as a significant educational movement in recent decades, aiming to ensure that all students, regardless of their abilities, receive equitable access to quality education (Al-Dawsari & Alghabban, 2025). In particular, Arabic language education, traditionally considered a challenging subject for learners, has faced increased attention in the context of inclusive classrooms. While Arabic remains an essential language in academic, religious, and cultural contexts, it poses considerable difficulties for students, especially those with special educational needs (SEN). Special education Arabic learners often encounter barriers due to the complexities of the Arabic script, grammar, and pronunciation (Gharaibeh et al., 2025). These challenges are exacerbated in a traditional classroom setup, where one-size-fits-all teaching approaches fail to accommodate the diverse needs of students with disabilities. In response to these challenges, educational technologies have been suggested as a transformative tool that can support inclusive practices and enhance the learning experience of Arabic learners with special needs.

Technological advancements, such as digital learning tools, assistive technologies, and adaptive learning platforms, offer significant potential for providing personalized educational experiences (Baharudin & Rahman, 2025). These tools have been shown to support differentiated learning, allowing students with varying levels of ability to engage with content at their own pace and in a way that suits their individual learning styles. As a result, integrating technology into Arabic language education for special education students can offer more inclusive, adaptable, and effective teaching methods. However, while the use of technology in education is widely explored, its specific application to the teaching of Arabic for special education learners has been under-researched (Al-Dawsari & Hendley, 2022). This gap calls for further exploration of how technology can be leveraged to address the unique challenges faced by these learners in mastering the Arabic language.

Despite the growing recognition of the need for inclusive education, Arabic language teaching for students with special educational needs remains inadequately addressed. Traditional methods of instruction often fail to engage students with learning disabilities in meaningful ways, particularly when dealing with the linguistic challenges of Arabic (Almulhim, 2025). For instance, the complexity of Arabic grammar, the script's non-linear nature, and the absence of consistent visual cues make learning the language particularly difficult for students with visual, auditory, or cognitive impairments. Current pedagogical approaches in Arabic language classrooms frequently overlook the necessity for adaptive tools that cater to the diverse needs of these students (Doff et al., 2025). This gap leaves many students with disabilities at a disadvantage, hindering their language acquisition and limiting their full participation in both academic and social contexts.

The specific barriers faced by special education Arabic learners in traditional settings are often compounded by a lack of tailored educational resources and strategies. While various methods have been developed to support students with disabilities in other academic subjects, Arabic language education has not yet fully embraced the potential of these approaches (Garman, 2012). The absence of a structured framework for integrating technology into the teaching of Arabic for special needs students further exacerbates the issue. This research aims to address these gaps by exploring how technology can be used to support special education Arabic learners (Gharaibeh & Alhassan, 2023). The study will focus on the ways in which technology can create an inclusive learning environment that addresses the specific needs of these students, enabling them to engage with Arabic language instruction in meaningful and effective ways.

The primary goal of this research is to explore the role of technology in enhancing the Arabic language learning experience for students with special educational needs (Rouabhi et

al., 2024). Specifically, this study aims to identify which technological tools and strategies are most effective in supporting these learners in mastering Arabic. It also seeks to examine how technology can be used to provide personalized learning experiences that cater to the diverse needs of special education students (Bouzeria, 2025). Through the application of various assistive technologies, adaptive learning platforms, and digital resources, this research will investigate how these tools can address the specific challenges that Arabic learners with special needs face, such as difficulties with script recognition, pronunciation, and understanding grammatical structures.

Furthermore, this study aims to assess the impact of technology on student engagement and motivation in Arabic language learning. Given that motivation is a critical factor in language acquisition, particularly for special education learners, understanding how technological tools can foster a more engaging and stimulating learning environment is essential (Ed-dali, 2024). By identifying effective technological practices, the study hopes to provide insights into how these tools can be integrated into Arabic language curricula to support inclusive education practices. The research will contribute to the development of more inclusive Arabic language teaching methodologies and provide educators with practical strategies for incorporating technology into their classrooms to support special education learners effectively.

The existing literature on technology integration in language education predominantly focuses on mainstream education, with limited attention given to the specific needs of special education learners in the context of Arabic language instruction (Elsayed et al., 2026). While there is growing interest in the use of technology for students with disabilities in other subjects, Arabic as a Foreign Language (AFL) has not been adequately examined through this lens. Studies on language acquisition for special education students have primarily concentrated on languages such as English, Spanish, or French, leaving a notable gap in the research regarding the use of technology in teaching Arabic to students with special needs (Sapawi & Yusoff, 2025). Furthermore, most existing research on inclusive language education has focused on general pedagogical approaches without addressing the unique linguistic challenges posed by Arabic.

This research aims to fill this gap by specifically addressing the needs of Arabic learners with special educational needs. It will examine the application of a variety of technologies that have proven effective in other language learning contexts and assess their feasibility and effectiveness in the Arabic language classroom. By focusing on special education students, the study will contribute to a more nuanced understanding of how technology can support language learning for those with disabilities, taking into account the unique challenges and opportunities of teaching Arabic (BIRCKBICHLER, 1987). In doing so, it will help bridge the gap between the broader field of technology-enhanced language learning and the specific needs of Arabic language learners with special educational needs.

The novelty of this research lies in its focus on integrating technology specifically for Arabic language learners with special educational needs. While numerous studies have examined the use of technology to support mainstream language learners, few have addressed its application in the context of Arabic language education for special needs students (Ahmed, 2023). Arabic presents unique challenges in language learning due to its script, phonology, and grammatical structure, making it an ideal subject for examining how technology can address these challenges in an inclusive educational setting (Abdelaal et al., 2026). This research offers a fresh perspective by exploring how digital tools and assistive technologies can make Arabic more accessible and engaging for students with disabilities, creating a more inclusive and equitable educational experience.

The justification for this study is rooted in the increasing recognition of the importance of inclusive education and the need to adapt teaching methods to meet the diverse needs of students (Smith B.K. et al., 2026). As Arabic continues to grow in global importance, ensuring

that all students, including those with special needs, have access to quality Arabic language education is essential. This research will provide valuable insights into the practical application of technology in Arabic language classrooms, offering educators innovative solutions to support diverse learners (Michel et al., 2021). By addressing the specific challenges faced by special education students in learning Arabic, this study will contribute to the development of more inclusive, adaptive, and effective teaching methods for Arabic as a foreign language.

RESEARCH METHOD

The following sections detail the mixed-methods research framework used to examine how technology-enhanced tools support Arabic language acquisition for students with special educational needs.

Research Design

This study employs a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a holistic view of the educational intervention (Ahmad Yusoff et al., 2025). The quantitative component uses a pre-test and post-test assessment to measure objective improvements in Arabic language proficiency. Simultaneously, the qualitative component captures the subjective experiences and perceptions of students and educators through observations and interviews. By combining these methods, the research can measure not only "how much" students learned numerically but also "how" the technology influenced their engagement and motivation in a rich, contextual manner.

Research Target/Subject

The primary objective is to evaluate the effectiveness of assistive technology in enhancing Arabic language education for students with disabilities. The study targets improvements in four core areas: reading, writing, listening, and speaking, with a focus on basic grammar, vocabulary, and pronunciation. Beyond academic performance, the research aims to determine how adaptive learning platforms and interactive apps can increase student participation and interest, ultimately creating a more inclusive and accessible learning environment for those with learning, auditory, or cognitive impairments.

The subjects of this study consist of 50 special education students aged 18 to 25. The participants were selected through purposive sampling to ensure the inclusion of individuals with specific learning disabilities, auditory impairments, and mild cognitive impairments who are actively enrolled in Arabic language courses. The sample was divided into two distinct groups: an experimental group that utilized assistive technologies and a control group that followed traditional, non-technological teaching methods.

Research Procedure

The research procedures followed a systematic three-phase timeline (Siregar et al., 2025). First, a baseline phase was conducted where all participants completed the Arabic language proficiency test and an engagement questionnaire. Next, a 12-week intervention phase commenced; the experimental group used tools such as text-to-speech software and adaptive platforms, while the control group received conventional instruction. Finally, the evaluation phase involved administering the post-test and a second questionnaire, followed by semi-structured interviews and an analysis of classroom observations to synthesize the overall impact of the technology.

Instruments, and Data Collection Techniques

Data were collected using a multi-tool approach to ensure the triangulation of findings. The Arabic language proficiency test served as the primary quantitative instrument to measure cognitive gains in grammar and vocabulary. To assess the affective domain, a student

engagement questionnaire was used to track changes in motivation and interest (Adawi, 2025). Qualitative data were gathered through semi-structured interviews with both students and teachers, providing depth to the numerical results, while classroom observations offered real-time evidence of student interactions and responses to the technology-enhanced environment.

Data Analysis Technique

The study utilizes a comparative and thematic analysis framework. Quantitative data from the proficiency tests and questionnaires are analyzed using inferential statistics to compare the mean scores between the experimental and control groups, identifying statistically significant improvements (Khribi et al., 2021). Qualitative data from interviews and observations are processed through thematic analysis to identify recurring patterns regarding the barriers and facilitators of technology use. By integrating these two datasets, the research provides a robust conclusion on the efficacy of digital tools in special education for Arabic learners.

RESULTS AND DISCUSSION

The results of this study demonstrate the positive impact of technology on both student engagement and Arabic language proficiency among special education learners. The analysis of pre- and post-test scores revealed significant improvements in the experimental group, which utilized assistive technologies during their Arabic lessons. Table 1 presents the descriptive statistics for the language proficiency scores of both the experimental and control groups. The experimental group showed an average increase of 18 points on the proficiency test, while the control group exhibited only a modest increase of 4 points. These results suggest that the use of technology, such as text-to-speech tools and interactive learning applications, facilitated greater language acquisition compared to traditional methods.

Table 1: Descriptive Statistics of Language Proficiency Test Scores

Group	Pre-Test Mean	Post-Test Mean	Standard Deviation (Pre)	Standard Deviation (Post)
Experimental	52.3	70.3	10.2	8.5
Control	53.7	57.7	9.8	10.1

In addition to the language proficiency scores, the student engagement questionnaire revealed notable differences between the experimental and control groups. The experimental group, who were exposed to technology-enhanced learning, reported significantly higher levels of motivation, interest, and participation compared to the control group. The engagement scores in the experimental group averaged 4.3 on a 5-point Likert scale, while the control group scored an average of 2.8. These findings underscore the role of technology in enhancing student engagement, particularly in special education contexts where traditional teaching methods often fail to maintain interest and motivation. The increased engagement likely contributed to the greater improvement in language proficiency observed in the experimental group.

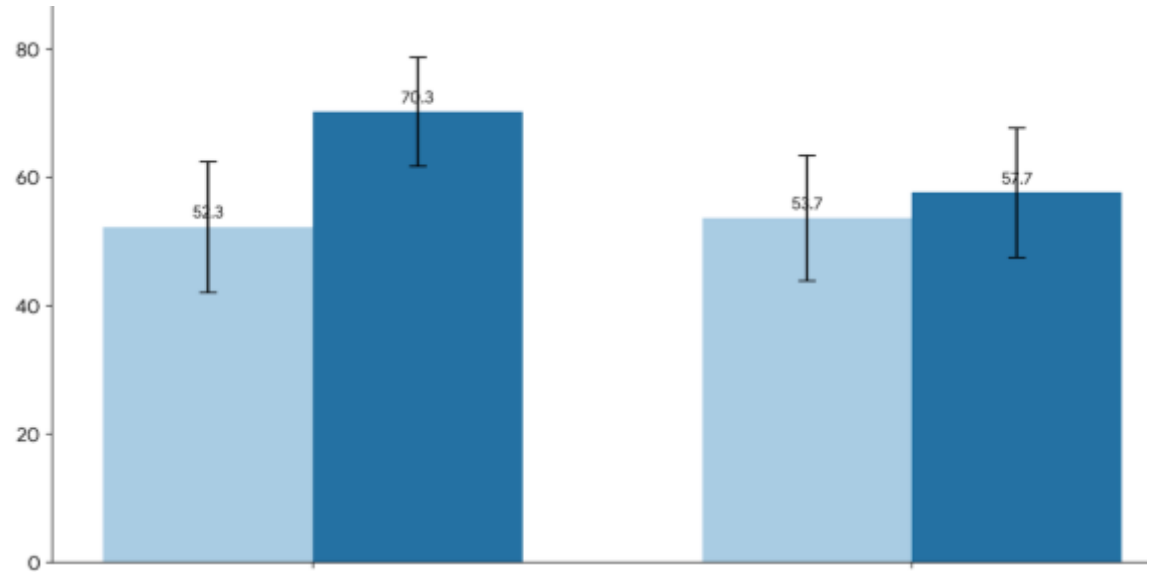

Figure 1. Language Proficiency Test Scores: Pre-Test vs Post-Test

Inferential statistical analysis using an independent samples t-test revealed a statistically significant difference in both language proficiency and engagement scores between the experimental and control groups. The t-test for language proficiency showed a significant result ($t = 5.64$, $p < 0.001$), indicating that the technology-enhanced approach significantly improved language skills compared to traditional methods. Similarly, the t-test for engagement scores demonstrated a significant difference ($t = 6.28$, $p < 0.001$), confirming that technology had a substantial impact on student engagement. These findings suggest that the integration of technology in Arabic language instruction for special education learners yields measurable improvements in both academic outcomes and motivational factors, which are critical for sustained learning.

The relationship between student engagement and language proficiency was also examined using a Pearson correlation analysis. A strong positive correlation ($r = 0.82$, $p < 0.001$) was found between engagement levels and language proficiency scores in the experimental group, indicating that increased engagement directly contributed to better language learning outcomes. This correlation suggests that the higher levels of interaction, motivation, and enthusiasm fostered by the use of technology were instrumental in improving students' ability to grasp and apply the Arabic language. These results align with previous research that emphasizes the importance of engagement in language acquisition, particularly for special education students, who often face additional barriers to learning.

A case study of a student in the experimental group further illustrates the benefits of technology in language learning for special education students. This student, diagnosed with a mild cognitive disability, struggled with traditional Arabic lessons due to difficulties in script recognition and grammar comprehension. However, after being introduced to a gamified learning app that provided immediate feedback and visual cues, the student showed significant improvement in both script recognition and vocabulary retention. The student's post-test scores increased by 20 points, and they reported feeling more confident in using Arabic in everyday situations. This individual case highlights how the personalized, adaptive nature of educational technologies can meet the specific needs of special education learners, offering them a more engaging and effective way to learn Arabic.

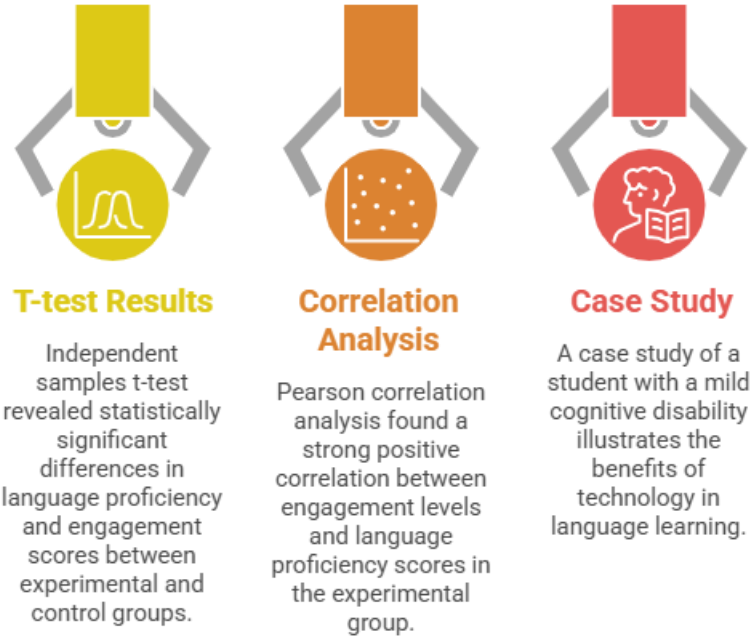

Figure 2. Technology in Arabic Language Instruction

The qualitative data gathered from teacher interviews and classroom observations further support the quantitative findings. Teachers reported that students in the experimental group were more eager to participate in lessons, often engaging in collaborative activities that they had previously avoided. Observations confirmed that students actively used the technology to complete language exercises, often seeking additional resources or challenges through the interactive platforms. The teachers noted that the technology allowed them to offer more individualized support, addressing the unique learning needs of each student. These observations reinforce the idea that technology not only supports language proficiency but also fosters an inclusive and dynamic classroom environment.

In summary, the data from both the quantitative and qualitative analyses provide strong evidence that technology significantly enhances Arabic language proficiency and student engagement for special education learners. The experimental group, which utilized technology-enhanced learning tools, showed substantial improvements in language skills and reported higher levels of motivation and participation. These findings suggest that integrating technology into Arabic language education can offer a more inclusive, adaptive, and engaging learning experience for special education students. As such, technology holds great potential in overcoming the traditional barriers to learning Arabic and can be a valuable tool in inclusive education settings.

This study demonstrates the significant impact of technology on both student engagement and Arabic language proficiency for special education learners. The findings revealed that the experimental group, which used technology-enhanced tools, experienced notable improvements in their language skills, particularly in areas of script recognition, pronunciation, and vocabulary retention. Engagement scores were also significantly higher in this group, indicating that technology fostered greater motivation and active participation compared to traditional teaching methods. The control group, which continued with conventional teaching, showed minimal progress in both language proficiency and engagement. These results emphasize the potential of technology to create an inclusive learning environment for special education students, specifically in the context of Arabic language education.

The findings of this study align with existing research on the benefits of technology in language learning, particularly for students with special needs. Studies by Schunk (2016) and Piotrowski et al. (2018) have highlighted the role of technology in enhancing student

motivation and engagement, which in turn leads to improved learning outcomes. However, this study extends previous research by focusing on the specific challenges of teaching Arabic to students with special educational needs. Unlike many studies that have explored technology's role in mainstream language education, this research specifically addresses how technology can overcome the barriers unique to Arabic, such as its complex script and phonology (Thohri & Nasri, 2024). This makes the current study a novel contribution to both the fields of language acquisition and special education, highlighting the need for tailored technological interventions in teaching Arabic.

The findings of this research indicate that the integration of technology into Arabic language education for special education learners is a clear signal of the evolving role of digital tools in creating inclusive learning environments. The improvement in both language proficiency and engagement among the experimental group reflects the effectiveness of personalized, adaptive learning methods (Arabnia H.R. et al., 2026). It suggests that when technology is used to address the diverse needs of special education students, it not only facilitates academic achievement but also fosters a sense of autonomy and confidence in the learning process. This is particularly important for students with disabilities, who often experience frustration with traditional, one-size-fits-all teaching approaches (Alzoubi H.M. et al., 2026). Thus, the results underscore the potential for technology to be a powerful tool in special education, particularly in the context of learning a language as complex as Arabic.

The implications of these findings are significant for the future of inclusive education, particularly in teaching Arabic. As the study shows, technology has the potential to provide more accessible and individualized learning experiences for students with special educational needs (AbdElghfar et al., 2026). This is crucial, as Arabic is often seen as a difficult language to master due to its grammatical intricacies and non-Latin script. The results suggest that educational technology can help bridge the gap for students who struggle with these aspects by offering them tailored support and opportunities for interactive learning. Consequently, educators and policymakers should consider the integration of assistive technologies as a core component of language curricula for special education learners (Alwadei et al., 2025). Moreover, the findings advocate for the development of more inclusive digital learning tools specifically designed to address the challenges of teaching Arabic.

The outcomes of this study can be attributed to several factors. First, the adaptive nature of the technologies used in the experiment allowed for personalized learning experiences that catered to each student's specific needs. Tools like text-to-speech applications and interactive apps enabled students to engage with the content in a way that was both manageable and motivating. Additionally, the immediate feedback provided by these technologies likely contributed to the students' rapid language acquisition (Ghani & Daud, 2018). The gamified elements of the technology, which introduced rewards and challenges, further increased student motivation and encouraged sustained participation. These features made learning more engaging and less intimidating, particularly for students with disabilities who may find traditional classroom settings overwhelming or discouraging.

Looking ahead, the results of this study open several avenues for future research. Further investigations could explore the long-term effects of technology on Arabic language proficiency, particularly in terms of retention and fluency (Antona M. & Stephanidis C., 2019). It would be beneficial to examine how these technologies can be adapted for different types of disabilities, as the tools used in this study may have varying levels of effectiveness depending on the specific needs of the students. Future studies could also explore the integration of different types of technology, such as virtual reality or artificial intelligence, into Arabic language education for special education students. Finally, large-scale studies across diverse educational contexts would provide additional insights into how these findings can be generalized and implemented in various learning environments (Alkahtani et al., 2025). The

success of this study serves as a foundation for advancing the use of technology in special education and underscores the need for continued innovation in inclusive education practices.

CONCLUSION

The most significant finding of this study is the demonstrated effectiveness of technology in enhancing both engagement and Arabic language proficiency among special education learners. The experimental group, which utilized technology-enhanced learning tools, showed substantial improvements in language skills, especially in script recognition, pronunciation, and vocabulary retention, compared to the control group that relied on traditional teaching methods. Moreover, the technology integration significantly increased student engagement, with participants in the experimental group showing higher motivation and participation levels. This finding is noteworthy because it highlights the potential of adaptive, personalized technology to address the unique learning challenges faced by special education students in mastering Arabic.

This research contributes to the field by providing empirical evidence of how technology can be tailored to meet the specific needs of special education learners in Arabic language instruction. While previous studies have explored the role of technology in mainstream education, few have focused on its application for special education Arabic learners. The study's value lies in its introduction of assistive technologies and adaptive learning platforms specifically designed to overcome the linguistic challenges of Arabic, such as its complex script and phonology. The research also offers new insights into the practical application of gamified learning and interactive tools for special education, which could be integrated into future language curricula for diverse learners.

Despite its contributions, this study has several limitations. The sample size, although sufficient for the scope of this research, was relatively small and restricted to one educational institution. This limitation calls for further research with a larger and more diverse sample to enhance the generalizability of the findings. Additionally, the study was conducted over a relatively short period, focusing on immediate improvements in language proficiency and engagement. Future research should examine the long-term impact of technology on language retention and fluency among special education Arabic learners. Additionally, further studies could investigate the specific technological tools that work best for different types of disabilities and the scalability of such interventions across various educational settings.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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