

Review Article

Cite this article: Saad, R., Baharudin, H., & Nik Yusoff, N. M. R. (2025). The Use of Digital Teaching Tools to Support Arabic Speaking Skills in Secondary School: A Systematic Literature Review. *Educational Process: International Journal*, 17, e2025404.
<https://doi.org/10.22521/edupij.2025.17.404>

Received June 15, 2025

Accepted August 11, 2025

Published Online August 24, 2025

Keywords: Digital teaching tools, Arabic speaking skills, secondary schools, literature reviews

Author for correspondence:

Harun Baharudin

✉ harunbaharudin@ukm.edu.my

✉ Faculty of Education, Universiti Kebangsaan Malaysia (UKM)

The Use of Digital Teaching Tools to Support Arabic Speaking Skills in Secondary School: A Systematic Literature Review

Roslizawati Saad , Harun Baharudin , Nik Mohd Rahimi Nik Yusoff 

Abstract

Background/purpose. A significant challenge in teaching Arabic at the secondary level is developing pronunciation, fluency, and communication. Despite increased use of digital tools in instruction, a gap remains in understanding their effectiveness in improving Arabic speaking skills. This article aims to identify the types of digital teaching tools used to support Arabic speaking skills in secondary school education and categorize them based on their pedagogical functions related to speaking subskills, such as pronunciation, fluency, and oral communication.

Materials/methods. This systematic literature review (SLR) addresses this gap by analyzing empirical studies published between 2021 and 2025. The review followed the PRISMA protocol, and relevant articles were retrieved from Scopus, Web of Science (WOS), and Google Scholar. Using defined search strings and eligibility criteria, 23 studies were selected for analysis.

Results. The findings were categorized into two key themes: (1) types of digital tools used (mobile application language learning (MALL), simulation-based tools, video and caption-based tools, gamified and interactive applications, and learning management systems (LMS), and (2) functional classification (pronunciation, fluency, and oral communication). Results indicate that tools incorporating mobile application language learning (MALL), simulation-based tools, video and caption-based tools, gamified and interactive applications, and learning management systems (LMS) significantly improve learners' motivation and speaking performance.

Conclusion. This review underscores the potential of digital tools in Arabic-speaking instruction and offers insights for educators, curriculum developers, and researchers. It also recommends further exploration of effective integration strategies and long-term impacts on student outcomes.



OPEN ACCESS

© The Author(s), 2025. This is an Open Access article, distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution, and reproduction, provided the original article is properly cited.

1. Introduction

In 21st-century digital education, digital teaching tools are increasingly important in transforming language pedagogy. Tools such as mobile application language learning (MALL), simulation-based tools, video and caption-based, gamified and interactive applications, and learning management systems (LMS) have revolutionized traditional approaches in the classroom. The ability of digital tools to deliver linguistic input visually, auditorily, and interactively makes them an alternative medium that is flexible and responsive to students' learning needs. Past studies have also shown that using digital technology enriches the learning experience and opens opportunities for self-directed learning, strengthening teacher control, and access to more authentic and structured language input (Al-Mansoori, 2020).

In the context of language teaching, oral skills, especially speaking, are a key component of effective communication. However, speaking skills are often among the most difficult to master, especially when teaching a second or foreign language such as Arabic (Din & Seman, 2019; Pawlak & Szyszka, 2018; Gilakjani, 2012). Digital teaching tools have great potential in supporting the development of students' speaking skills through pronunciation exercises, intonation imitation, voice recordings, automatic feedback, and virtual interactions, and in this regard, integrating technology functions as a visual aid and a catalyst for developing more dynamic and contextual oral competence. Despite the increase in the use of digital tools in language learning, their effectiveness in improving pronunciation, fluency, and oral communication has yet to be comprehensively reviewed among secondary school students, especially in Arabic.

In Malaysia, Arabic is taught as an additional language in the curriculum of selected secondary schools, especially in religious schools and religious classes. However, student performance in Arabic speaking skills is often reported to be moderate to poor (Rasit & Ismail, 2024; Rizan & Baharudin, 2021). Due to constraints in terms of exposure to native speakers, grammar-oriented teaching methods, and the absence of a conducive language communication environment. Nevertheless, current practices remain teacher-centric and technology-limited. Malaysia's 1BestariNet/Frog VLE initiative, which equips 10,000 schools with Internet and virtual learning platforms, indicates an increasing readiness to integrate digital pedagogies— a key enabler for digital-supported oral instruction (KPM, 2021). The Digital Education Policy (Dasar Pendidikan Digital (DPD)) by the Ministry of Education (KPM) promotes six strategic pillars: student digital fluency, teacher competence, infrastructure, and content quality, which explicitly encourage technological integration across curricula, including secondary education (KPM, 2023; eCentral, 2023).

Furthermore, the teaching approach is still teacher-centered and not supported by modern technology, and teachers' perceptions of the use of technological tools lead to a lack of interest in using digital teaching tools. This is evidenced by a study conducted by the Ministry of Education, 80% of teachers only use technological software or digital teaching tools for less than one hour a week (KPM, 2013). Therefore, efforts to explore the potential of digital teaching tools in supporting the teaching of speaking skills require greater attention.

Previous studies have discussed speaking skills, such as the studies by Japri and Baharuddin (2025), Tai'Tullah and Daud (2025), Din and Seman (2019), and Mohd et al. (2025). However, this study does not include the aspect of educational technology. Although there are studies on the use of technology or digital teaching tools in speaking skills, most of the studies are more focused on languages other than Arabic. However, several studies focus on Arabic, but the studies conducted are more focused on teaching Arabic only and do not focus on speaking skills. Previous studies are also more focused on quantitative and qualitative aspects compared to SLR studies. Previous studies also do not focus on the category of digital teaching tools based on specific sub-skills, such as pronunciation and fluency, and how these tools can be effectively integrated into the secondary

school curriculum, as studied by Osman et al. (2024), Saja et al. (2021), Azzahra and Rachmawati (2025), and Ritonga et al. (2022). Therefore, there is an urgent need to conduct an SLR to consolidate various past findings in a comprehensive, directed, and critical framework.

This study is important to provide information on the appropriate use of digital tools by Arabic language teachers in their teaching. This is because studies on the use of digital teaching tools specifically for teaching Arabic are still lacking compared to other languages. This lack of research has led Arabic language teachers to consider the use of digital tools as limited and inappropriate for their teaching. Although digital tools have been widely used in the context of English as a Second Language (ESL), no systematic study has been conducted on their use in teaching Arabic speaking skills at the secondary school level. This has led to a lack of teacher knowledge about the most appropriate digital tools to support Arabic language teaching, particularly in areas such as pronunciation, fluency, and oral communication. By conducting this SLR, it is hoped that this study will help foster a more positive attitude towards the use of digital teaching tools among teachers while also adapting the use of these tools in teaching Arabic speaking skills. The findings from this study are expected to offer practical guidance for enhancing Arabic language teaching at the secondary school level through the appropriate use of digital tools.

This article aims to identify the types of digital teaching tools used to support Arabic speaking skills in secondary education and categorize these tools based on their pedagogical functions related to speaking subskills such as pronunciation, fluency, and oral communication. It also answers the research question: what types of digital teaching tools can be used to support Arabic speaking skills, and how are these tools categorized based on their role in improving pronunciation, fluency, and oral communication in Arabic? This study focuses on digital teaching tools suitable for Arabic language teachers to enhance Arabic speaking skills. The novelty of this research lies in detailing the types and categories of digital tools based on their focus on teaching speaking skills, specifically in areas like pronunciation, fluency, and oral communication.

2. Literature Review

2.1. Theoretical Framework

The Theory of Reasoned Action (TRA), introduced by Fishbein and Ajzen (1975), is a psychological model that explains how individual attitudes, intentions to act, and actual behavior are related. According to TRA, intentions to act are the key factors that influence a person's actions. These intentions are shaped by two elements: attitudes toward the action and subjective norms, which include the views and expectations of others regarding the action. In other words, if individuals have a positive attitude toward the action and are confident in something that supports their attitudes and behaviors, they are more likely to perform that action.

This theory is highly relevant to using digital tools to support Arabic-speaking skills among secondary school students. In this case, teachers' attitudes toward digital tools and subjective norms, such as previous studies demonstrating the effectiveness of digital tools in foreign language learning, will influence Arabic teachers' willingness to integrate technology into their teaching.

Meanwhile, the Technology Acceptance Model (TAM), introduced by Davis (1989), is used to understand the factors that affect an individual's acceptance of new technology. TAM is based on two main variables: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived Usefulness (PU) is the extent to which users believe that using technology will improve their performance in a specific task. Perceived Ease of Use (PEOU) refers to how easy users believe the technology is to operate without requiring significant effort. These two factors are crucial when it comes to using digital tools to enhance Arabic speaking skills. Perceived Usefulness relates to teachers' beliefs that digital tools such as mobile apps, speech recognition software, web-based

platforms, and Learning Management Systems (LMS) can help students develop Arabic speaking skills more effectively. Perceived Ease of Use concerns the comfort level teachers have in using these technologies. If digital tools are easy to learn and user-friendly, teachers are more likely to adopt them.

Overall, the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) complement each other in understanding the factors that influence the adoption of digital tools for teaching Arabic speaking skills. Both models offer a comprehensive view of teachers' intentions and acceptance of technology, which ultimately affects the effective integration of digital tools to enhance students' speaking abilities in secondary schools. These theories have also been used in previous studies related to technology and digital teaching tools, such as Rahmayanti et al. (2021), Silva et al. (2023), Syaharani and Yasa (2022), Pham Thi et al. (2025), Dung et al. (2025), Pratama (2021), and Alsharida et al. (2021).

2.2 The Use of Digital Teaching Tools for Arabic Speaking Skills

In recent decades, the integration of digital teaching tools has significantly transformed the pedagogical landscape, particularly in language education. Technologies such as mobile applications, speech recognition software, web-based platforms, and Learning Management Systems (LMS) have demonstrated potential in promoting learner engagement and autonomy (Criollo-C et al., 2022). These tools offer interactive and multimodal experiences, facilitating meaningful language use, especially critical for developing speaking skills. In Arabic as a second or foreign language, digital interventions are increasingly viewed as essential due to the challenges learners face in mastering complex phonological and morphological features.

Empirical evidence supports the use of digital tools in enhancing key components of speaking skills, including pronunciation, fluency, and oral interaction (Benlaghrissi & Ouahidi, 2024; Zghoul & Bataineh, 2024). For instance, tools such as Flipgrid have been found to enhance students' self-expression through asynchronous video sharing and peer feedback. Likewise, mobile applications such as Duolingo, Babbel, and Cake have shown positive effects on learners' motivation, pronunciation accuracy, and speaking confidence (Arif & Kleden, 2024; Huseynova, 2024). These tools offer gamified environments and speech analysis features that support both practice and self-assessment, thereby addressing the limitations of traditional face-to-face instruction.

Numerous studies have confirmed the effectiveness of digital tools in improving speaking performance among Arabic learners (Osman et al., 2024; Saja et al., 2021; Azzahra & Rachmawati, 2025 & Ritonga et al., 2022). For example, mobile-assisted project-based learning significantly outperformed traditional methods in enhancing speaking skills (Benlaghrissi & Ouahidi, 2024). Simulation-based approaches and caption-reduction strategies have also proven beneficial in developing learners' fluency and pronunciation (Kamrach & Sriwichai, 2025; Cardenas-Claros & Ramirez-Orellana, 2024). E-portfolios, meanwhile, have enabled self-monitoring and iterative improvement, further supporting learners' oral development (Br Sembiring et al., 2025). These findings highlight the pedagogical potential of integrating technology to support the acquisition of Arabic oral skills.

This review underscores the transformative role of digital tools in supporting Arabic-speaking skills, particularly through increased learner engagement, personalized feedback, and access to authentic language use. Nevertheless, sustainable integration requires adequate teacher training, curriculum alignment, and infrastructural support. Future research should explore long-term impacts, comparative effectiveness of tool types, and learner preferences in different educational contexts. An SLR will not only map the state of current research but also offer pedagogical recommendations for educators and policymakers aiming to modernize Arabic language instruction at the secondary level.

3. Methodology

According to Wilson (2014), methodology refers to the strategies and techniques used by individuals to conduct systematic research. A systematic literature review will be conducted to obtain data related to elements of digital teaching tools that can be used by teachers in learning Arabic speaking skills. This qualitative methodology uses data analysis that is available or obtained from previous studies.

This study used PRISMA (Preferred Reporting Items for Systematic Review and Meta-analysis). PRISMA is a publication standard that is widely used in the field of medicine and public health. PRISMA has 27 items that can be followed in forming an SLR (Moher et al., 2009). Although this SLR is in the field of social sciences, PRISMA is still suitable for reference because it helps to form clear research questions and allows for systematic searches to be carried out. In addition, PRISMA minimizes various types of bias and helps the author to synthesize studies well (Howard et al., 2019). Through PRISMA, there are five processes that need to be carried out, namely identification, screening, eligibility, quality assessment, Data Extraction, and Analysis, before being able to form study objectives, research questions, and subthemes from the selected articles.

3.1. Identification

Identification is a process that involves identifying and diversifying appropriate keywords for an article search. Keywords are required during the search process to increase the accuracy of the articles. In this study, three main keywords were selected, namely, speaking skills, digital teaching tools, and secondary school. To diversify the keyword, synonyms, related words, and variations of the main keywords were also searched on an online thesaurus, past research keywords, and the Scopus database, as well as in expert views. Table 1 presents the results of the identification process of this study.

Table 1. Searching from Wos, Scopus and Google Scholar

Database	Search string
Web of Science (WoS) (n = 25)	TS= (("speaking skills" OR "oral proficiency" OR "oral communication" OR "pronunciation" OR "fluency" OR "oral performance") AND ("digital teaching tools" OR "digital tools" OR "educational technology" OR "mobile application" OR "CALL" OR "MALL" OR "e-learning" OR "online platform" OR "multimedia learning") AND ("secondary school" OR "secondary education" OR "high school")) – Access Mei 2025
Scopus (n = 74)	TITLE-ABS-KEY (("speaking skills" OR "oral proficiency" OR "oral communication" OR "pronunciation" OR "fluency" OR "oral performance") AND ("digital teaching tools" OR "digital tools" OR "educational technology" OR "mobile application" OR "CALL" OR "MALL" OR "e-learning" OR "online platform" OR "multimedia learning") AND ("secondary school" OR "secondary education" OR "high school")) -Access Mei 2025
Google Scholar (n = 368)	"Digital teaching tools" for "speaking skills" in secondary schools -Access Mei 2025

Using the selected keywords, an article was searched in three main databases: the Web of Science, Scopus, and Google Scholar. Three databases were selected based on some advantages. First, according to Gusenbauer and Haddaway (2021), databases such as the Web of Science and Scopus possess comprehensive searches, more stable search results, and more advanced search

functionality than other databases. Additionally, Martin-Martin et al. (2018) emphasize the advantages of the Web of Science and Scopus regarding quality control and a systematic indexing system.

The search technique used to find articles in this database (Web of Science and Scopus was an advanced search using basic functions, such as Boolean Operators (AND, OR), phrase searching, truncation, wild card, and field codes' function (refer to table 1). In addition to this technique, manual searches using handpicking methods in Google Scholar and Science Direct and snowballing methods on selected articles were adopted. Based on the keywords, databases, and search techniques used, 25 Wos articles, 74 Scopus articles, and 368 Google Scholar articles were successfully obtained, and all these articles went through the second stage in the systematic search strategy, which was screening.

3.2. Screening

Screening is a process in which inclusion or exclusion criteria are set to select suitable articles to form the systematic literature review (Shaffril et al., 2020). A total of 212 articles successfully gathered in the identification process were subjected to the screening process. The first criterion was the year of publication being within the last 5 years (2021 – 2025) for WoS and Scopus, and 2 years (2024-2025) for Google Scholar. This period selection was based on several justifications. Firstly, it was in line with the concept of study maturity in Kraus et al. (2020), as many related articles have successfully obtained reliable data during this period.

The searches on major databases showed a significant surge of publications relating to the elements of the digital learning tools used for teaching speaking skills from 2021 to 2025 for WoS and Scopus, and 2024 to 2025 for Google Scholar. For quality control, only articles published in Malay and English were selected to avoid confusion in reading and understanding. Review articles were also excluded because the main objective of this systematic literature review was to identify past research findings rather than reviews. Therefore, only articles with relevant empirical data were considered in this study.

This study included an inclusion criterion in this process. Inclusion is important to ensure all selected articles contribute relevant findings to the systematic literature review (Refer to Table 2). In this study, the selected articles contained findings that focus on the elements of the digital learning tools for teaching speaking skills. Therefore, the articles on teaching speaking skills that do not explicitly state the elements used in digital learning tools in learning were removed. After the screening process, 147 articles were eliminated, leaving 65 articles for the next process.

Table 2. The Inclusion Criteria

	Inclusion criteria		
	WoS	Scopus	Google Scholar
Year of publication	2021-2025	2021-2025	2024-2025
Publication type	Journal articles	Journal articles	Journal articles
Language	Malay and English	Malay and English	Malay and English
Types of findings	Empirical	Empirical	Empirical
Focus of findings	Data related to the elements of digital tools can be used by Arabic language teachers to teach speaking skills		

3.3. Eligibility

The remaining 65 articles were subjected to a second screening process, known as eligibility. The eligibility screening process is carried out to ensure that all selected articles are relevant and can be used in the SLR. The process is accomplished by consulting the title and its abstract. If no decision is reached after reading a study's title and abstract, its methodology, results, and discussion sections are consulted.

In this process, a total of 26 articles were excluded because they did not focus on the elements of the digital teaching tools used by Arabic language teachers to teach speaking skills. The 26 articles were eliminated as some studies focused on university students, contained duplicated records, were not fully assessed, or were written as a scoping review. Following the process, 39 articles were subjected to the next process, which was quality assessment. The systematic search process, using PRISMA, in this study, is shown in Figure 1.

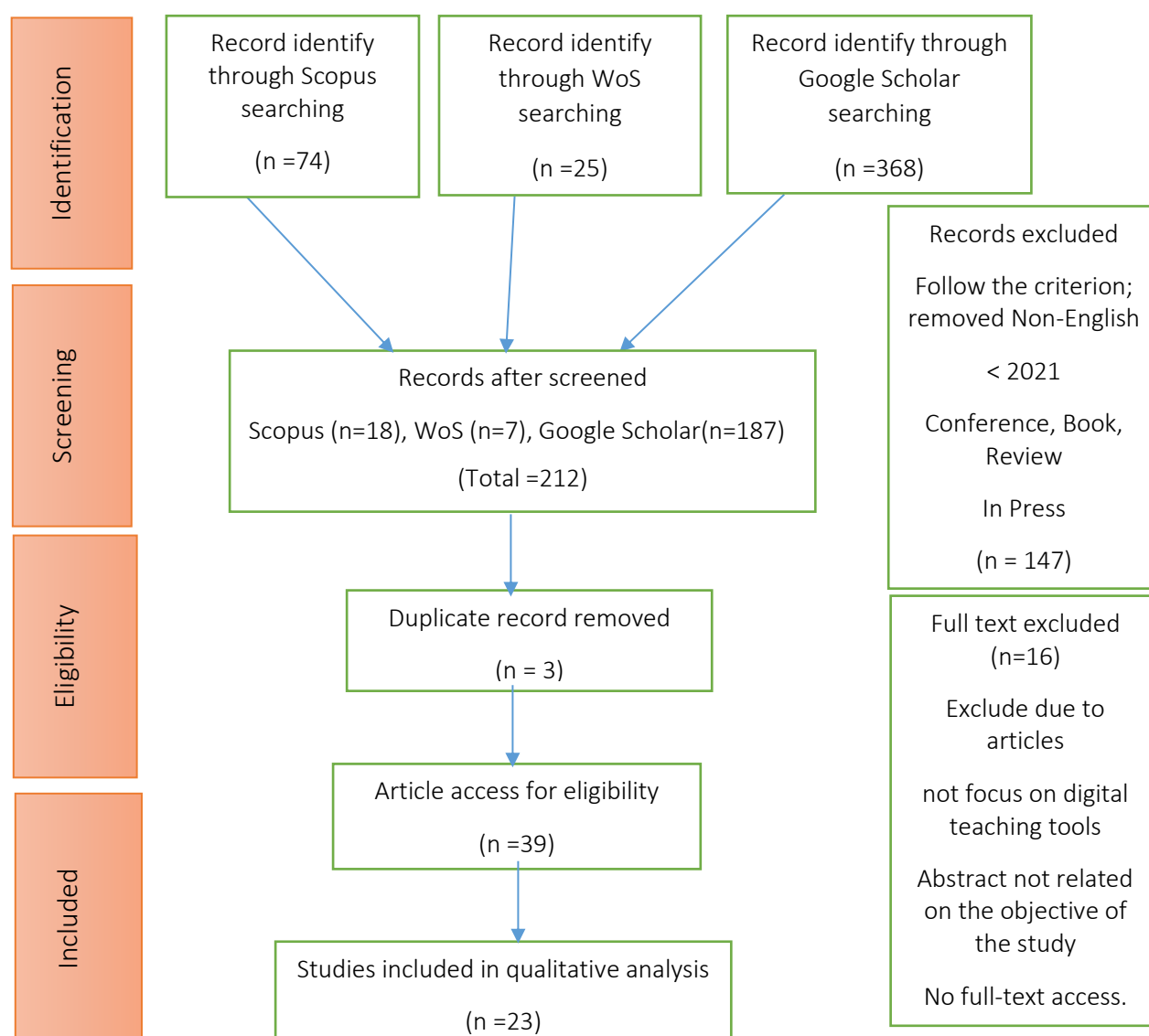


Figure 1. Flow Diagram of the Proposed Searching Study (Source: Hamzah et al. (2022))

3.4. Quality Assessment

Selected articles were then evaluated for quality. This minimized bias and helped identify articles that might have flaws in terms of methodology [9]. Two evaluators were selected among the researchers for the purpose of evaluation. Because the systematic literature review combined articles and documents from various research designs, which were quantitative, qualitative, and mixed methods, the MMAT (Mixed Methods Appraisal Tool) was referred to assist in the evaluation process (Hong et al., 2018). Each article was evaluated based on two general criteria and five specific criteria. The first step was to assess the quality of the article based on two general criteria, as follows. (1) Are the research questions clearly stated? (2) Can the data obtained answer the stated research questions? Articles in this study were required to meet both aspects before proceeding to the separation stage. During the separation stage in the quality assessment process, the research design of an article was identified to clarify whether it was qualitative, quantitative, or mixed methods. The articles and documents were then evaluated based on five specific criteria. Each criterion came with three response options. 'Yes', 'No', or 'Cannot tell'. To agree with an article, a mutual agreement among evaluators was required. If an agreement could not be reached, the evaluators were required to seek a second opinion. Of the total 39 articles evaluated, 23 met at least 3 criteria and hence were included in this systematic literature review; meanwhile, 16 articles were excluded and are summarized in Tables 3.

Table 3. Quality Evaluation of Quantitative, Mixed Methods, and Qualitative Articles (Excluded)

Basic/Study Criteria	Are the research question stated early?	Can the obtained data answer the stated research question?	Is the sampling strategy used relevant the research question?	Is the selected sample representative of the studied population?	Is the measurement used appropriately?	Is the risk nonresponse bias low?	Is the statistical analysis used appropriate to answer the research question?
Quantitative Studies							
Mahadi and Ariska (2022)	N	N	N	N	N	N	N
Wang (2021)	N	N	N	N	N	N	N
Al Mahadi (2025)	N	N	N	Y	Y	N	N
Ishibie (2025)	N	N	N	Y	Y	N	N
Tajik (2025)	N	Y	Y	N	N	N	N
Filosofi et al. (2024)	N	N	N	N	N	N	N
Result	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
Mixed Methods							
Islam et al. (2025)	Y	N	Y	N	N	N	N
Hasan (2024)	Y	N	Y	N	N	N	N

Brakhmetova (2024)	Y	N	Y	N	N	N	N
Zhou (2024)	Y	N	Y	N	N	N	N
Result	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude
Qualitative							
Abbozova (2025)	N	Y	N	N	N	N	N
Md. Shahjalal (2025)	N	N	Y	Y	N	N	N
Mubin et al. (2025)	N	N	Y	Y	N	N	N
Irmayani et al. (2024)	Y	Y	N	N	N	N	N
Li (2024)	Y	N	N	N	N	N	N
Ali (2020)	N	N	N	N	N	N	N
Result	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude	Exclude

3.5. Data Extraction and Analysis

Next, the process of extracting data from the articles in which high quality had been determined was carried out. This process was performed by two researchers. Since the focus of SLR was to review the findings from previous research on digital education tools used in teaching speaking skills, the data extraction process concentrated on three main parts of each article, namely the abstract, the results, and the discussion. If necessary, other sections of the articles, offering relevant data, would be read. The extracted data were then placed on a table to facilitate the analysis process. Once the relevant data were extracted, data analysis was conducted. Since the SLR is an integrative review, combining multiple research designs, a qualitative synthesis is considered the best analysis (Whittemore & Knalf, 2005). While numerous analyses could be used in qualitative synthesis, thematic analysis has been found to be among the most effective qualitative synthesis techniques for analyzing findings from various types of research designs (Fleming et al., 2019) because the method identifies patterns based on the similarity and association between the extracted findings.

This study examined the extracted findings to develop an appropriate theme. Data with similarities or associations were combined into a single dataset. The set was assigned a relevant theme. Two themes emerged from the process: (1) Types of Digital Teaching Tools Employed, and (2) Functional Classification: Pronunciation, Fluency, and Oral Communication. Then, the findings from each theme were examined again to form subthemes. Through this process, three subthemes were identified. All the themes and subthemes were re-examined and retained as they were relevant to the research questions. Lastly, two experts- one in the field of SLR and another in module development- validated all the themes and subthemes. Both experts agreed that the two main themes and subthemes, as shown in Tables 4 and 5, were appropriate and relevant to the objective and research questions. The objective and research questions are as follows:

The main objectives of this systematic literature review are:

1. To identify the types of digital teaching tools used to support Arabic-speaking skills in secondary school education.

2. To categorize these tools based on their pedagogical functions related to speaking subskills, such as pronunciation, fluency, and oral communication.

Based on the objectives, the following research questions are formulated:

1. What types of digital teaching tools have been used in secondary school settings to support Arabic speaking skills?

2. How are these tools categorized based on their functions in improving pronunciation, fluency, and oral communication?

Table 4. Theme 1: Types of Digital Teaching Tools Employed

Study	Research Design	Digital learning tools				
		Sub-Themes	Mobile Applications Language Learning (MALL)	Simulation-based tools	Video and Caption-based	Gamified and Interactive application Learning management systems (LMS)
Sarzhanova et al. (2023)	MX				/	
Criollo et al. (2022)	QN		/			
Benlaghrissi and Quahidi (2024)	QN		/			
Cardenes-Claros et al. (2024)	QL				/	
Kamrach and Sriwichai (2025)	QN			/		
Espiritu et al. (2023)	QN		/			
Alda (2023)	QL		/			
Zghoul and Bataineh (2024)	QN		/			
Wulyani et al. (2024).	MX					/
Br Sembiring et al. (2025)	QL					/
Arif and Kleden (2024)	QL		/		/	/

Study	Research Design	Digital learning tools				
	Sub-Themes	Mobile Applications Language Learning (MALL)	Simulation-based tools	Video and Caption-based	Gamified and Interactive application	Learning management systems (LMS)
Damayanti et al. (2025)	QN	/				
El Fiqri (2025)	QL	/				/
Huseynova (2024)	MX	/				
Yasa et al. (2024)	QN	/				
Oraz et al. (2024)	QN	/		/		/
Mohd Nabil et al. (2024)	QL			/		
Agustina and Haq (2024)	QN	/				/
Usup and Purwaningsih (2024)	MX	/				
Coskun and Solmaz (2024)	QN	/				
Jumanto et al. (2024).	QL	/				
Bilichenko et al. (2024)	QN	/				
Zahira et al. (2024)	QL	/	/	/	/	/

QN-quantitative QL-qualitative MX-mixed-methods

Table 5. Theme 2: Functional Classification (Pronunciation, Fluency and Oral Communication)

Study	Research Design	Functional classification		
	Sub-Themes	Pronunciation	Fluency	Oral Communication
Sarzhanova et al. (2023)	MX			

Criollo-C et al. (2022)	QN	/
Benlaghrissi and Quahidi (2024)	QN	/
Cardenes-Claros et al. (2024)	QL	
Kamrach and Sriwichai (2025)	QN	
Espiritu et al. (2023)	QN	
Alda (2023)	QL	
Zghoul and Bataineh (2024)	QN	/
Wulyani et al. (2024)	MX	
Kusuma and Indrayani (2025)	QL	/
Arif and Kleden (2024)	QL	
Br Sembiring et al. (2025)	QN	
El Fiqri, A.R., (2025)	QL	
Huseynova, S. (2024)	MX	
Yasa et al. (2024)	QN	
Oraz et al. (2024)	QN	/
Mohd Nabil et al. (2024)	QL	
Agustina and Haq (2024)	QN	/
Usup and Purwaningsih (2024)	MX	
Coskun and Solmaz (2024)	QN	
Jumanto et al. (2024)	MX	
Bilichenko et al. (2024)	QN	
Zahira et al. (2024)	QL	

QN-quantitative QL-qualitative MX-mixed-methods

4. Results and Findings

Before discussing the main findings, this section will focus on the background of the selected articles in systematic literature reviews. Of the 23 selected articles, one was published in 2022, three were published in 2023, fifteen were published in 2024, and four were published in 2025. The review revealed two overarching thematic domains: (1) Types of Digital Teaching Tools Employed and (2) Functional Classification: Pronunciation, Fluency, and Oral Communication.

RQ1-What types of digital teaching tools have been used in secondary school settings to support Arabic speaking skills?

4.1. Types of Digital Teaching Tools Employed

The studies reviewed demonstrate a wide variety of digital tools integrated into speaking instruction, broadly categorized into five types of tools:

4.1.1. Mobile-Assisted Language Learning (MALL) Applications

Mobile learning applications have become a significant tool in language education, particularly for enhancing speaking proficiency. Apps like Duolingo, Cake, Babbel, and Speak App have been widely reported to improve learners' pronunciation and fluency. Studies by Arif and Kleden (2024), Espiritu and Buaraphan (2023), Bilichenko et al. (2024), Zahira et al. (2024), and Huseynova (2024) indicate that these applications are not only user-friendly but also include gamified features, real-time feedback, and speech recognition to enhance learner engagement. Additionally, their flexible, self-paced nature allows learners to practice speaking consistently, promoting long-term oral skill development.

4.1.2. Simulation-Based Tools

Simulation-based tools, including role-playing tasks and voice blogging, have shown significant potential in fostering learners' confidence and fluency. According to Kamrach and Sriwichai (2025) and Oraz et al. (2024), learners demonstrated substantial speaking progress after engaging in real-world simulation scenarios. These interventions provide authentic communicative contexts and allow for repetitive practice, essential for developing spoken fluency. Additionally, simulations create a low-anxiety environment where learners feel safe to make mistakes and improve iteratively through meaningful interaction.

4.1.3. Video and Caption-Based Platforms

Video platforms such as *YouTube*, student-generated video projects, and caption-reduction strategies have been extensively used to offer learners exposure to authentic language use. Sarzhanova et al. (2023) found that engaging with English videos such as films and vlogs significantly improved learners' motivation and speaking skills. Cardenas-Claros and Ramirez-Orellana (2024) highlighted that progressively reducing captions enhances students' listening comprehension and oral output. Similarly, Agustina and Haq (2024) emphasized that video-based assignments contribute to improved pronunciation accuracy through repetitive practice and learner self-reflection.

4.1.4. Gamified and Interactive Applications

Gamified platforms like *Quizizz*, *Quizlet*, and other interactive mobile games contribute positively to vocabulary acquisition and student motivation, which are essential precursors to speaking fluency. Espiritu and Buaraphan (2023) and Huseynova (2024) reported that these tools, while not specifically designed for speaking instruction, indirectly support oral language development by building a strong lexical foundation and engaging learners in active, fun-based learning environments. The element of play increases learners' willingness to communicate and reduces speaking anxiety.

4.1.5. Learning Management Systems (LMS)

Learning Management Systems such as *Moodle*, *Google Classroom*, and *Edmodo* have been adapted to support speaking instruction by facilitating structured assignments, peer feedback, and integration of audiovisual tasks. Wulyani et al. (2024) demonstrated that although LMS platforms are not intended initially for speaking skill instruction, their flexibility allows educators to design practical speaking activities such as voice recordings, asynchronous discussions, and interactive presentations. The ability to track learner progress, provide formative feedback, and store multimedia resources makes LMS a valuable component of digital speaking instruction.

RQ2-How are these tools categorized based on their functions in improving pronunciation, fluency, and oral communication?

4.2. Functional Classification: Pronunciation, Fluency, and Oral Communication

The reviewed studies reveal that digital teaching tools fulfill distinct pedagogical functions across three core subskills of speaking: pronunciation, fluency, and oral communication. Regarding pronunciation development, tools such as *Cake*, *Speak App*, and video-based platforms demonstrated considerable efficacy in improving segmental articulation, rhythm, and intonation. Arif and Kleden (2024) and Kusuma and Indrayani (2025) highlighted that speech analysis functions, voice comparison features, and repetition-based tasks embedded within these applications contributed significantly to learners' accuracy and prosodic awareness.

For fluency enhancement, several MALL-based interventions (Criollo et al., 2022; Benlaghrissi & Ouahidi, 2024) reported notable gains in the smoothness and speed of oral production. Learners involved in mobile-assisted project-based learning displayed increased confidence and spontaneity in speech, supported by statistically significant results (e.g., $p < .05$ in pre- and post-test comparisons).

As for oral communication and interaction, tools that enabled asynchronous and synchronous video responses, such as *Flipgrid*, voice blogs, and video assignments, were highly effective in fostering communicative competence. Studies by Zghoul and Bataineh (2024), Oraz et al. (2024), and Agustina and Haq (2024) revealed that such tools facilitated real-time interaction, reflective speaking, and contextual language use. These technologies allowed learners to simulate authentic discourse situations, strengthening their ability to construct meaningful utterances and engage in extended dialogue. Table 6 clearly shows a summary of digital tools and their functional focus.

Table 6. Summary of Digital Tools and Their Functional Focus

Subskill Focus	Representative Tools	Notable Findings
Pronunciation	Cake App, Speak App, video projects	Improved articulation, segmental accuracy, and motivation
Fluency	Duolingo, Babbel, mobile-assisted projects	Gains in fluidity, confidence, and spontaneous production
Oral Communication	Flipgrid, Voice Blogging, Video Simulations	Enhanced interaction, narrative coherence, and real-world application

Voice-based platforms, mobile applications, and interactive videos can be tailored to Arabic phonological features and speaking goals, provided that cultural and linguistic authenticity are maintained. In conclusion, the systematic literature review of this study, which included 23 articles, revealed the primary elements of digital teaching tools and their functional classification: pronunciation, fluency, and oral communication. Teachers need to use these elements in teaching speaking skills to support students in improving their Arabic speaking skills. See table 7 below.

Table 7. Summary of Findings for the (23) Selected SLR Articles

	Study/Title	Aim	Methodology/ Sample	Findings
1.	Sarzhanova et al. (2023) The Educational Use of YouTube Videos for Communication	This research explored the types of EFL YouTube videos mostly watched by secondary students to enhance speaking skills in the	A mixed-methods study collected data via a questionnaire with the participation of 288	Results showed positive student attitudes towards the use of YouTube for learning English speaking skills. Learners preferred videos

	Study/Title	Aim	Methodology/ Sample	Findings
	Fluency Development in English: Digital Learning and Oral Skills in Secondary Education	school for gifted children in Kazakhstan.	secondary education students.	such as English-language films, music, and vlogs, which increased their motivation and confidence.
2.	Criollo et al. (2022). A Hybrid Methodology to Improve Speaking Skills in English Language Learning Using Mobile Applications	The study tested a hybrid model combining traditional teaching and mobile learning.	A quantitative experimental approach was used with high school students aged 17–19, who were native Spanish speakers learning English as a second language.	Mobile learning can help motivate students in their studies and enhance their English communicative skills.
3.	Benlaghrissi and Ouahidi (2024). The impact of mobile-assisted project-based learning on developing EFL students' speaking skills	examines how integrating MALL through mobile phones and PBL, defined as mobile-assisted project-based learning or mobile-assisted projects, improves Moroccan secondary school students' speaking performance	An experimental study involving 91 Moroccan secondary school students was randomly assigned to one experimental group and two control groups. The study evaluated the effects of mobile-assisted project-based learning (MALL-PBL).	Statistically significant differences were found in speaking scores across all four sub-skills in favor of the mobile-assisted group. The intervention proved more effective than both conventional and standard PBL approaches.
4.	Cardenas-Claros et al. (2024). Progressive Reduction Of Captions In Language Learning	examines the perceptions of high school learners of English regarding a pedagogical intervention involving progressive reduction of captions (full, sentence-level, keyword captions, and no-captions) in enhancing language learning.	Exploratory qualitative case study	Students appreciated progressive caption reduction for improving comprehension, vocabulary, pronunciation, and listening confidence. The gradual removal of visual aids enhanced learners' sense of independence.
5.	Kamrach and Sriwichai (2025). The Use of Simulation Techniques to Enhance English Speaking Skills of EFL Secondary School Students	This study aims to compare the English speaking skills of EFL secondary school students in Thailand before and after using simulation techniques, to investigate the progress of the students' speaking skills, and to study the students' attitudes towards simulation techniques.	Using a pre-test and post-test design, this quasi-experimental study involved ten eighth-grade students in Thailand. The intervention included five simulated speaking scenarios	Post-test scores were significantly higher across all simulations. Students reported improved vocabulary, real-life communication practice, and greater self-confidence when using simulation techniques.
6.	Espiritu and Buaraphan (2023). Innovative Approach to Teaching EFL	This study delved into the development and implementation process of a mobile game-based app	A three-phase study including a needs analysis, development, and implementation of a	The mobile app significantly improved pronunciation and fluency. Students

	Study/Title	Aim	Methodology/ Sample	Findings
	through a Game-Based Speaking Mobile Application	created by teachers, evaluated its effectiveness, and identified key features for enhancing speaking skills.	mobile speaking app. Participants included 287 students (123 high school and 164 university students).	highlighted interactive and gamified features as key to their positive experiences and increased engagement.
7.	Alda (2023). Mobile-Assisted Language Learning (MALL) in Senior High School English Classes	This study describes the integration of the Mobile-Assisted Language Learning (MALL) strategy in Senior High School English classes	A qualitative study utilizing lesson observations and interviews across six senior high schools (three public and three private) in Cebu, Philippines.	MALL was found to enhance student engagement and language exposure. However, limited teacher autonomy and a lack of professional training were cited as major barriers to effective integration.
8.	Zghoul and Bataineh (2024). Flipgrid: Unlocking The English Speaking Potential Of Jordanian Adolescent Efl Learners	This study investigated the effect of using Flipgrid, an application through which teachers gather learners in virtual classrooms to allow interaction through video and audio sharing, on Jordanian EFL seventh-grade students' speaking performance (along with the features of fluency, pronunciation, grammar, and vocabulary).	A quasi-experimental design was used, as two intact seventh-grade sections of 25 students each were drawn from Al Morooj Secondary School for Girls (Amman, Jordan)	The results revealed that the Flipgrid-instructed group outperformed the control group in speaking overall and along the features of fluency, pronunciation, grammar, and vocabulary.
9.	Wulyani et al. (2024). Overcoming challenges: Indonesian EFL teachers' strategies for using moodle in high schools	This study examines Indonesian EFL teachers' perceptions of Moodle, the challenges they encounter, and their strategies to overcome them	A sequential explanatory mixed-method design was used with 72 high school EFL teachers from different regions in Indonesia. Data were collected through surveys and interviews.	Teachers viewed Moodle positively for its flexibility and accessibility. However, technical issues and limited feedback tools hindered speaking instruction. Solutions included peer collaboration and content adaptation.
10	Br Sembiring et al. (2025). Exploring Cognitive Development Through Speaking: How Do E-Portfolios Strengthen Speaking Skills?	This study explores the role of E-portfolios in students' cognitive development in speaking, focusing on fluency and pronunciation	A qualitative phenomenological study was conducted through semi-structured interviews and researcher field notes. Participants were eleventh-grade students at a high school in Bali, Indonesia	The findings indicate that E-portfolios significantly enhanced students' fluency and pronunciation through repeated practice, self-assessment

	Study/Title	Aim	Methodology/ Sample	Findings
11.	Arif et al. (2024) “The Implementation of Cake English Learning Appplication in Teaching Pronunciation for EFL Secondary School Graders”	This study explores the implementation of the Cake English Learning App as a tool to enhance pronunciation skills among eighth-grade students at SMPN 1 Larantuka	Qualitative, observations and interviews with students and teachers	The results show that the app's interactive features, such as gamified quizzes, video lessons, and speech recognition, significantly improved student engagement, motivation, and pronunciation accuracy.
12.	Damayanti et al. (2025) Enhancing English Speaking Competence Using The Cake App: Infographics as the Innovative Guidances for Teaching Speaking in Tourism Contexts.	This study is intended to develop infographics of the Cake App Ideas for teaching speaking in a 12th-grade tourism vocational high school context.one English teacher was involved as the research subject.	This Design and Development study employed the DDE model (Richey & Klein, 2014), using a quantitative technique to analyze the data.	Infographics based on Cake App were rated excellent in content and design, and the teacher reported using them effectively in speaking instruction.
13.	El Fiqri (2025). English Teacher Perceptions of the Use of ChatGPT as A Tool in English Language Learning	This study explores English teachers' perceptions of ChatGPT as a tool for English language learning	Qualitative, semi-structured interviews were conducted with two English teachers at SMK Negeri 1 Majene.	ChatGPT is perceived positively for generating materials; concerns over critical thinking and a lack of speaking features are noted.
14.	Huseynova (2024) The Impact of Digital Tools on Foreign Language Acquisition in Under-Resourced Educational Settings in Azerbaijan.	This study investigates the impact of digital tools on foreign language learning in rural and remote regions of Azerbaijan	Mixed-methods, survey of 300 students across 3 regions in Azerbaijan	The results indicate that digital tools significantly enhance students' motivation, vocabulary retention, and speaking fluency
15.	Yasa et al. (2024). Developing Infographics of Cakeapp Based Teaching Speaking Ideas for Tourism Vocational High School English Teacher in 11 th Grade at SMK Negeri 2 Singaraja	This research aims to develop infographic-based teaching and speaking ideas for Tourism Vocational High School English teachers in 11th grade, odd semester at SMK Negeri 2 Singaraja, and to assess the quality of the infographics of the CakeApp-based teaching and speaking ideas being developed.	Design and Development (DDE model), product validation.	CakeApp infographics met instructional criteria and were deemed high-quality for tourism ESP speaking lessons.

	Study/Title	Aim	Methodology/ Sample	Findings
16.	Oraz et al. (2024). “The Impact of Voice Blogging on Senior School Students’ Kazakh Oral Speech Skills”	This study aimed to assess the impact of a 12-week voice blogging intervention on the oral proficiency of Russian-speaking upper secondary students learning Kazakh in Kazakhstan.	Experimental, 84 students divided into blogging and control groups	Voice blogging significantly improved fluency and complexity but not accuracy; students gave positive feedback
17.	Mohd Nabil et al. (2024). Immersive language learning: evaluating augmented reality filter for ESL speaking fluency teaching	This study aims to explore how the integration of augmented reality (AR) filters into English as a second language (ESL) can enhance speaking fluency teaching	Qualitative	AR filters supported speaking fluency across diverse learning styles and proficiency levels
18.	Agustina et al. (2024). The Effectiveness of Video Project Assignment on Students’ Speaking skill in SMP	To measure the effectiveness of video project assignment on students’ speaking skill at SMP YPI Darussalam 1 Cerme	Quantitative, The research population includes 7th Grade at SMP YPI Darussalam 1 Cerme. With a total of 25 Students.	Video project assignments significantly improved students’ speaking skills
19.	Usup and Purwaningsih (2024) Analysis of the Impact of Social Media as a Learning Tool in Language Subjects	This study aims to analyze the effectiveness of social media as a learning tool in language subjects, focusing on its impact on student engagement and language proficiency	mixed method, 200 high school students.	Social media increased engagement and proficiency, promoting interactive and practical
20.	Coşkun and Solmaz (2024). Exploring High School Students' Acceptance and Use of Mobile Applications for English Language Learning	This study explored the perceptions and attitudes of high school English learners towards mobile language learning applications in a southeastern province of Türkiye. It also examined how factors such as gender, age, school type, smartphone ownership, and regular internet access influence the use of these applications among high school EFL learners.	Survey of 650 students aged 15–17	Students held positive attitudes towards mobile learning apps; usage influenced by gender, age, and access.
21.	Jumanto et al. (2024). Towards SDG Digital Quality Learning: a Conceptual DLR based Model for Online Language	To encourage digital quality learning as part of SDG quality education through proposing a DLR-based model on Zoom and WhatsApp as the main digital learning platforms for	Qualitative, conceptual model for Zoom & WhatsApp integration	The DLR model supports flexible, independent speaking and writing practice in digital

	Study/Title	Aim	Methodology/ Sample	Findings
	Encoding-Skill Enhancement.	enhancing language encoding skills, i.e., speaking and writing skills, within online learning activities.		
22.	Bilichenko et al. (2024). The effectiveness of interactive online courses for speech competence development in non-language-major students.	The article aims to analyse the effectiveness of interactive online courses in developing the speech competence of non-language major students.	Quantitative, interactive online course evaluation	Courses enhanced speaking competence, flexible learning, and were user-friendly with practical
23.	Zahira et al. (2024). Media Influence on English Language Proficiency: A Study on ESL Learners Of Sialkot, Pakistan.	This study examines the impact of various media forms on English language proficiency among ESL learners in Pakistan, highlighting the challenges they encounter in enhancing their language skills through traditional methods. It aims to understand how different media, including television, radio, print, and online platforms, affect vocabulary acquisition, pronunciation, and overall language proficiency.	Descriptive qualitative, 30 ESL learners using interviews and focus groups	Media significantly improved vocabulary and speaking attitudes; recommended effective language teaching strategies.

5. Discussion

The findings of this systematic literature review (SLR) highlight the effectiveness of digital teaching tools in improving speaking skills, particularly in terms of pronunciation, fluency, and oral communication. The reviewed tools, including Mobile-Assisted Language Learning (MALL) applications, simulation-based tools, video and caption-based platforms, gamified applications, and Learning Management Systems (LMS), have shown significant positive effects on learners' speaking abilities. This discussion will connect the findings with the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) and will also examine how these tools can be applied to Arabic language teaching, even though most studies focus on English.

5.1. Understanding Digital Tools in Language Teaching

The five categories of digital tools identified in this review, MALL applications, simulation-based tools, video platforms, gamified applications, and LMS, have demonstrated diverse benefits in supporting speaking skills. MALL applications like Duolingo, Cake, and Speak App are particularly effective in enhancing pronunciation and fluency through real-time feedback, gamification, and speech recognition. Similarly, simulation-based tools, such as role-playing tasks and voice blogging, offer authentic language practice in low-stress environments, fostering confidence and fluency. Video and caption-based platforms, including YouTube and student-generated videos, improve pronunciation accuracy and fluency by providing repeated practice and exposure to authentic language use. Gamified applications like Quizizz and Quizlet support vocabulary learning and reduce

speaking anxiety, while LMS such as Moodle and Google Classroom facilitate structured speaking assignments, asynchronous discussions, and interactive presentations, promoting continuous practice and formative feedback.

These tools contribute to three key subskills in speaking: pronunciation, fluency, and oral communication. As noted in the review, these tools significantly enhance learners' segmental articulation, rhythm, and intonation, leading to greater confidence and proficiency in both fluent speech production and meaningful interaction (Zahira et al., 2024; Jumanto et al., 2024; Coskun & Solmaz, 2024; and Usup & Purwaningsih, 2024). Several studies, such as Sarzhanova et al. (2023) and Huseynova (2024), demonstrate that MALL applications considerably improve language learners' speaking skills through repetitive practice and speech recognition feedback, which are crucial for enhancing pronunciation and fluency (Arif & Kleden, 2024).

5.2. Relating the Findings to Theoretical Frameworks: TRA and TAM

We can apply the Theory of Reasoned Action (TRA) and the Technology Acceptance Model (TAM) to better understand why teachers choose to adopt these digital tools in their teaching practices.

- The Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975) suggests that an individual's intention to carry out a behavior is influenced by their attitude toward the behavior and subjective norms (i.e., the influence of others, such as peers or educational administrators). In this context, teachers' attitudes regarding the effectiveness of digital tools and their perceptions of these tools' benefits for student learning are essential. If teachers believe that tools like MALL applications or simulation-based platforms will significantly enhance students' pronunciation, fluency, and communication skills, they are more inclined to include these tools in their teaching. Moreover, the subjective norms component indicates that if peers, school leaders, or the wider educational community endorse the use of these tools, teachers will feel motivated to adopt them. This is especially relevant in environments where there is institutional backing for integrating technology into education. Sandy et al., (2023) highlighted that teachers are more likely to adopt educational technologies if they view them as effective and aligned with institutional goals.

- The Technology Acceptance Model (TAM) (Davis, 1989) builds on TRA by emphasizing perceived ease of use and perceived usefulness as key factors in adopting technology. Perceived ease of use refers to how much a teacher believes that using a specific digital tool will require minimal effort, while perceived usefulness indicates how much the teacher believes the tool will enhance their teaching effectiveness. In Arabic language education, tools with user-friendly interfaces and features like speech recognition in MALL apps are very likely to be adopted by teachers. These tools are seen as valuable for improving students' pronunciation and fluency, which are essential for language learning. Additionally, the ability of LMS platforms to incorporate multimedia resources and monitor student progress can boost their perceived usefulness, making them appealing choices for Arabic language instructors. This aligns with Al-Mansoori's (2020) and Al-Mansoori et al.'s (2023) findings, where teachers preferred tools that were easy to implement and showed clear improvements in student results.

5.3. Application of Digital Tools in Arabic Language Teaching

Although many of the reviewed studies focus on English-speaking contexts, the findings can be applied to Arabic language education, particularly in non-native learning environments like Malaysia. The tools studied, such as MALL applications, simulation-based tools, and video platforms, are not inherently language-specific and can be easily adapted for Arabic language education. Arabic learners face challenges like those in other languages, such as mastering pronunciation and fluency. Since Arabic pronunciation involves unique sounds and intonation patterns, specific training is required, which digital tools can support. For example, MALL apps like Cake and Speak App can be customized

to emphasize Arabic's distinct segmental and suprasegmental features (e.g., emphatic consonants and intonation). These apps offer immediate feedback and encourage self-paced learning, which is especially helpful for students struggling with Arabic's complex phonological system.

Similarly, simulation-based tools such as role-playing and voice blogging can be adapted to replicate real-world interactions in Arabic, enabling learners to practice conversational skills and enhance their fluency in a risk-free environment. Video-based platforms, like YouTube, can expose learners to authentic Arabic content, including films, vlogs, and interviews, helping students improve both pronunciation and fluency by imitating native speakers. These tools offer a valuable opportunity for learners to engage with the language in context, which is especially important for developing oral communication skills. According to Golonka et al. (2012), digital tools like video-based learning platforms can significantly enhance listening comprehension and speaking skills, which are crucial for Arabic learners who encounter challenges due to the language's complex phonology. The effectiveness of using digital teaching tools in Arabic speaking skills is also supported by Osman et al. (2024), Saja et al. (2021), Azzahra and Rachmawati (2025) and Ritonga et al. (2022).

6. Conclusion

This systematic literature review synthesised insights from 23 empirical studies published between 2022 and 2025, revealing the pedagogical potential of digital teaching tools in supporting Arabic-speaking skills at the secondary school level. The review identified two central themes: the types of digital tools employed and their functional roles in developing pronunciation, fluency, and oral communication. The findings demonstrate that mobile-assisted language learning applications, simulation tools, video-caption platforms, gamified applications, and learning management systems have been widely adopted to enhance students' engagement, motivation, and speaking proficiency. Tools such as Duolingo, Speak App, Flipgrid, and Moodle supported various speaking subskills through interactivity, repetition, real-time feedback, and contextual language use.

The integration of digital teaching tools such as MALL applications, simulation-based platforms, video tools, and LMS has shown promising results in improving pronunciation, fluency, and oral communication among language learners. Using the frameworks of TRA and TAM, we see that teachers are more likely to adopt these tools if they view them as useful and easy to use in their classrooms. Although most studies mainly focus on English, the key features of these tools, such as real-time feedback, flexible learning, and interactive tasks, are just as beneficial for Arabic language learners. By using these tools, Arabic educators can boost students' speaking skills, helping them overcome common challenges in pronunciation and fluency, and fostering stronger communication skills.

7. Suggestion

The findings of this systematic literature review on digital teaching tools suggest that future researchers consider and incorporate the mentioned elements into the production of digital teaching tools. This SLR has also shown that digital teaching tools help students enhance their speaking skills. Therefore, it is recommended to combine all these elements to create more interesting and impactful digital teaching tools for learning speaking skills.

Additionally, it is recommended that future systematic literature reviews focus on activities combined with digital teaching tools for learning speaking skills. Research on the activities suggested in digital teaching tools for speaking skills learning can provide an overview and guidance for developing more effective and robust activities.

This study also recommends a separate search for articles in journals related to educational and learning only. By limiting the review to journals on educational and learning, the result will be more relevant, focused, accurate, and aligned with the academic issues studied.

Declarations

Author Contributions. R.S.: Literature review, conceptualization, methodology, data analysis, and writing. H.B. and N.M.R.: Methodology and review editing. All authors have read and approved the publication of the article's final version.

Conflicts of Interest. The authors declared no potential conflict of interest.

Funding. We extend our sincere gratitude to the Ministry of Education, Malaysia, and the Faculty of Education, Universiti Kebangsaan Malaysia (UKM), for their financial support for this research through Grant GG-2024-039.

Ethical Approval. Not applicable

Data Availability Statement. Research data are available upon request.

References

- Abbozova, Z. (2025). Effective Methods of Teaching English in a General Secondary School Using Innovative Technologies. *International Multidisciplinary Journal for Research & Development*, 1(3), 37–38. Retrieved from <https://inlibrary.uz/index.php/imjrd/article/view/7993>
- Agustina, N. A., & Haq, M. A. I. (2024). The Effectiveness of Video Project Assignment on Students' Speaking Skills in SMP. JEET, *Journal of English Education and Technology*, 5(03), 206–221.
- Alda, R. C. (2023). Mobile-Assisted Language Learning (MALL) in Senior High School English Classes. *World Journal of English Language*, 13(6), 211–211. <https://doi.org/10.5430/wjel.v13n6p211>
- Ali, Z. (2020). Artificial Intelligence (AI): A Review of its Uses in Language Teaching and Learning. In IOP Conference Series: *Materials Science and Engineering* (Vol. 769, No. 1, p. 012043). IOP Publishing. <https://doi.org/10.1088/1757-899x/769/1/012043>
- Al Mahadi, K. N. (2025). Optimizing ICT Integration for Enhanced Secondary Education in Bangladesh. *Asian Journal of Education and Social Studies*, 51(4), 229-235. <https://doi.org/10.9734/ajess/2025/v51i41864>
- Al-Mansoori, S. (2020). *Analisis Fonetik dalam Bahasa Arab: Teori dan Amalan*. Dubai: Penerbit Ilmiah Timur Tengah.
- Al Mansoori, A., Ali, S., Pasha, S. A., Alghizzawi, M., Elareshi, M., Ziani, A. D., & Alsridi, H. (2023). Technology Enhanced Learning Through Learning Management System and Virtual Reality Googles: A Critical Review. *From Industry 4.0 to Industry 5.0: Mapping the Transitions*, 557–564. https://doi.org/10.1007/978-3-031-28314-7_48
- Alsharida, R., Hammood, M., & Al-Emran, M. (2021). Mobile Learning Adoption: A Systematic Review of the Technology Acceptance Model from 2017 to 2020. *International Journal of Emerging Technologies in Learning (IJET)*, 16(5), 147–162. <https://doi.org/10.3991/ijet.v16i05.18093>
- Arif, U. Q., & Kleden, E. T. (2025). The Implementation of Cake English Learning Application in Teaching Pronunciation for EFL Secondary School Graders. *English Learning Innovation (englie)*, 6(1), 14-24. <https://doi.org/10.22219/englie.v6i1.37524>
- Azzahra, J. P., & Rachmawati, M. (2025). The Alifbee Platform as a Tool for Arabic Speaking Skill Learning. *Alsuna: Journal of Arabic and English Language*, 8(1), 145-158.
- Benlaghrissi, H., & Ouahidi, L. M. (2024). The Impact of Mobile-Assisted Project-Based Learning on Developing EFL Students' Speaking Skills. *Smart Learning Environments*, 11(1), 18. <https://doi.org/10.1186/s40561-024-00303-y>

- Bilichenko, A., Martynenko, N., Derevianko, L., Mizina, O., & Iatsyna, M. (2024). The effectiveness of Interactive Online Courses for the Speech Competence Development in Non-Language-Major Students. *Revista Eduweb*, 18(3), 204-222. <https://doi.org/10.46502/issn.1856-7576/2024.18.03.16>
- Brakhmetova, A. (2024). Advancing English as a Foreign Language Instruction through Innovative Technologies: Perspectives and Practices in Kazakhstan. *Eurasian Science Review: An International peer-reviewed multidisciplinary journal*, 2(2), 86–93. <https://doi.org/10.63034/esr-49>
- Br Sembiring, B. D., Kusuma, I. P. I., & Indrayani, L. (2025) “Exploring Cognitive Development Through Speaking: How Do E-Portfolios Strengthen Speaking Skills? Introduction, Literature Review, Method, Result and Discussion, Conclusion”, *Journal of Psychology and Instruction*, 9(1).
- Cárdenas-Claros, M. S., Ramírez-Orellana, D., & y Juanita, C. P. H. (2024). Progressive Reduction of Captions in Language Learning. *Journal of Information Technology Education: Innovations in Practice*, 23.
- Coşkun, Z., & Solmaz, O. (2024). Exploring High School Students' Acceptance and Use of Mobile Applications for English Language Learning. *Journal of Language Education and Research*, 10(2), 636-661. <https://doi.org/10.31464/jlere.1515400>
- Criollo-C, S., Guerrero-Arias, A., Vidal, J., Jaramillo-Alcazar, Á., & Luján-Mora, S. (2022). A Hybrid Methodology to Improve Speaking Skills in English Language Learning Using Mobile Applications. *Applied Sciences*, 12(18), 9311. <https://doi.org/10.3390/app12189311>
- Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Damayanti, M. R. M., Utami, I. L. P., & Agustini, D. A. E. (2025). Enhancing English Speaking Competence Using The Cake App: Infographics as the Innovative Guidances for Teaching Speaking in Tourism Contexts. *PROJECT (Professional Journal of English Education)*, 8(3), 735-740.
- Din, A. F. M., & Seman, M. (2019). Meningkatkan Kemahiran Bertutur Bahasa Arab Melalui Strategi Penguasaan Sebutan. *International Online Journal of Language, Communication, and Humanities*, 2(1), 85-99.
- Dung, T. M., Nga, N. T., Trung, T. T., & Trung, L. T. B. T. (2025). Understanding Student Engagement with Mobile Learning: A Structural Model for Interactive Education in Vietnam. *International Journal of Interactive Mobile Technologies*, 19(12).
- El Fiqri, A. R. (2025). English Teacher Perceptions of the Use of ChatGPT as A Tool in English Language Learning. *Tadangate Journal of Educational Research*, 2(1), pp.1–10.
- Espiritu, J. G. M., & Buaraphan, K. (2023). Innovative Approach to Teaching EFL through a Game-Based Speaking Mobile Application, 20 October 2023, PREPRINT (Version 1) Available at Research Square. <https://doi.org/10.21203/rs.3.rs-3459646/v1>.
- Fishbein, M., & Ajzen, I. (1975). *Belief, Attitude, Intention, and Behavior: An introduction to Theory and Research*. Addison-Wesley. <https://doi.org/10.2307/2065853>
- Filosofi, F., Pasqualotto, A., Paolizzi, E., Iandolo, G., Alonso-Campuzano, C., & Venuti, P. (2024). Enhancing Group Interactions and Story Quality in Primary School Students: an Investigation into the Impact of Collaborative Storytelling Methodologies. *Journal of Computers in Education*, 1–28. <https://doi.org/10.1007/s40692-024-00330-1>

- Fleming, J., & Zegwaard, K. E. (2018). Methodologies, Methods, and Ethical Considerations for Conducting Research in Work-Integrated Learning. *International Journal of Work-Integrated Learning*, 19(3), 205-213.
- Gilakjani, A. P. (2012). A Study of Factors Affecting EFL Learners' English Pronunciation Learning and the Strategies for Instruction. *International Journal of Humanities and Social Science*, 2(3), 119-128.
- Golonka, E. M., Bowles, A. R., Frank, V. M., Richardson, D. L., & Freynik, S. (2012). Technologies for Foreign Language Learning: A Review of Technology Types and their Effectiveness. *Computer Assisted Language Learning*, 27(1), 70–105. <https://doi.org/10.1080/09588221.2012.700315>
- Gusenbauer, M., & Haddaway, N. R. (2021). What every Researcher Should Know about Searching–Clarified Concepts, Search Advice, and an Agenda to Improve Finding in Academia. *Research Synthesis Methods*, 12(2), 136–147. <https://doi.org/10.1002/jrsm.1457>
- Hamzah, H., Hamzah, M. I., & Zulkifli, H. (2022). Systematic Literature Review on the Elements of Metacognition-Based Higher-Order Thinking Skills (HOTS) Teaching and Learning Modules. *Sustainability*, 14(2), 813. <https://doi.org/10.3390/su14020813>
- Hong, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., ... & Pluye, P. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for Information Professionals and Researchers. *Education for information*, 34(4), 285–291. <https://doi.org/10.3233/efi-180221>
- Howard, D. M., Adams, M. J., Clarke, T. K., Hafferty, J. D., Gibson, J., Shiralil, M., & McIntosh, A. M. (2019). Genome-Wide Meta-Analysis of Depression Identifies 102 Independent Variants and Highlights the Importance of the Prefrontal Brain Regions. *Nature Neuroscience*, 22(3), 343–352. <https://doi.org/10.1038/s41593-018-0326-7>
- Hasan, M. M. (2025). Exploring Hybrid Approach in Language Teaching Methods: A Comparative Study of Grammar Translation Method (GTM), *Direct Method (DM)*, and *Communicative Language Teaching (CLT)*. <https://www.researchgate.net/profile/Md-Hasan-633>
- Huseynova, S. (2024). The Impact of Digital Tools on Foreign Language Acquisition in Under-Resourced Educational Settings in Azerbaijan, 13 November 2024. <https://doi.org/10.20944/preprints202411.0976.v>
- Irmayani, I., Rahmawati, A., & Zahro, S. K. (2024). Exploring Students' Perceptions of 'Speakia' App For Speaking Lessons. *Edulitics Education, Literature, and Linguistics Journal*, 9(2), 140-153. <https://doi.org/10.52166/edulitics.v9i2.8213>.
- Ishibie, C. I. (2025). The Impact of Digital Technologies on French Language Learning. *Cascades, Journal of the Department of French & International Studies*, 3(1), 33-39.
- Islam, M. A., Awais, H. M., & Naveed, M. U. (2025). Video Games and Vocabulary Learning In EFL: A Comparative Study of Gamers and Non-Gamers. *International Premier Journal of Languages & Literature*, 3(1), 186-220.
- Japri, A. S., & Baharudin, H. (2025). Perspektif Guru Sekolah Rendah Daerah Telupid, Sabah: Isu dan Pendekatan Simulasi Lisan Frasa Bahasa Arab:(Primary Schools Teachers' Perspectives in Telupid District, Sabah: Issues and Approaches to Verbal Simulation of Arabic Phrases). *RENTAS: Jurnal Bahasa, Sastera dan Budaya*, 4(1), 16-34.
- Jumanto, J., Asmarani, R., Triwibowo, F. D., Pamungkas, H., Ramayanti, I., Harunasari, S. Y., & Adi, A. P. K. (2024). Towards SDG Digital Quality Learning: a Conceptual DLR-based Model for Online Language Encoding-Skill Enhancement. *Journal of Lifestyle and SDGs Review*, 4(3), e02369-e02369. <https://doi.org/10.47172/2965-730x.sdgsreview.v4.n03.pe02369>

- Kamrach, S., & Sriwichai, C. (2025). The Use of Simulation Techniques to Enhance English Speaking Skills of EFL Secondary School Students. *World Journal of English Language*, 15(1), 434–434. <https://doi.org/10.5430/wjel.v15n1p434>
- Kementerian Pendidikan Malaysia. (2021). *Teknologi Pendidikan – 1BestariNet & Frog VLE*. MOE press release.
- Kementerian Pendidikan Malaysia. (2023). *Dasar Pendidikan Digital*. eCentral.
- Kementerian Pendidikan Malaysia. (2013). *Pelan Pembangunan Pendidikan Malaysia 2013-2025*.
- Klopfer, E., Squire, K., & Jenkins, H. (2002). *Environmental Detectives: PDAs as a Window into a Virtual Simulated World*. <https://doi.org/10.1109/wmte.2002.1039227>
- Kraus, S., Breier, M., & Dasí-Rodríguez, S. (2020). The Art of Crafting a Systematic Literature Review in Entrepreneurship Research. *International Entrepreneurship and Management Journal*, 16, 1023–1042. <https://doi.org/10.1007/s11365-020-00635-4>
- Li, Y. (2024). Usability of ChatGPT in Second Language Acquisition: Capabilities, Effectiveness, Applications, Challenges, and Solutions. *Studies in Applied Linguistics and TESOL*, 24(1). <https://doi.org/10.52214/salt.v24i1.12864>
- Mahadi, I., & Ariska, D. (2022). The Effect of E-Learning Based on the Problem-Based Learning Model on Students' Creative Thinking Skills During the COVID-19 Pandemic. *International Journal of Instruction*, 15(2), 329–348.
- Martin-Martin, A., Orduna-Malea, E., Thelwall, M., & Lopez-Cozar, E. D. (2018). Google Scholar, Web of Science, and Scopus: A Systematic Comparison of Citations in 252 Subject Categories. *J. Inf.* 2018, 12, 136–147, [CrossRef]
- Md. Shahjalal. (2025). The Necessity of Blended Learning Materials in Higher Secondary Level for EFL Learners to Implement SDG 4 in Bangladesh. *Journal of Arts and Linguistics Studies*, 3(1), 1489–1504. <https://doi.org/10.71281/jals.v3i1.286>
- Mohd, K. N., Ismail, N. S., Ab Rahman, N. A., & Yusoff, N. S. (2025). Strategi Pembelajaran Kemahiran Bertutur Bahasa Arab dalam Kalangan Pelajar-Pelajar yang Menggunakan Kurikulum Bersepadu Dini [Strategies for Learning Arabic Speaking Skills among Students Using Early Integrated Curriculum]. *Muallim Journal of Social Sciences and Humanities*, 9(3), 1–14. <https://doi.org/10.33306/mjssh/348>
- Mohd Nabil, N. S., Nordin, H., & Ab Rahman, F. (2024). Immersive Language Learning: Evaluating an Augmented Reality Filter for ESL Speaking Fluency Teaching. *Journal of Research in Innovative Teaching & Learning*, 17(2), 182–195. <https://doi.org/10.33306/mjssh/348>
- Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *BMJ* 2009. 339: <https://www.bmj.com/content/339/bmj.b2535>
- Mubin, K., Muhajir, M., Khotijah, Y. S., Khoiri, A. A., & Guangli, M. (2025). Arabic Language Curriculum Development Management at Multilingual Islamic Boarding School: A Case Study of PPM 4 Language Al-Muhibbin. *IJECA (International Journal of Education and Curriculum Application)*, 8(1), 142–150. <https://doi.org/10.31764/ijeca.v8i1.29962>
- Oraz, A. N., Malikov, K. T., & Sadykov, T. (2024). The Impact Of Voice Blogging on the Oral Proficiency of Upper Secondary Students In L2 Kazakh Speaking. *Journal of Educational Sciences (2520-2634)*, 78(1). <https://doi.org/10.26577/jes20247801014>

- Osman, R. A. H., Amran, A. A. C., Azman, Y., Alosman, A., & Idris, I. R. (2024). A Systematic Review on Using Technology Tools in Improving Arabic Speaking Skills Among University Students. In *International Conference on Languages and Communication (ICLC) 2024* (p. 92).
- Pawlak, M., & Szyszka, M. (2018). Researching Pronunciation Learning Strategies: An Overview and a Critical Look. *Studies in Second Language Learning and Teaching*, 8(2), 293-323. <https://doi.org/10.14746/ssllt.2018.8.2.6>
- Pham Thi, T. D., Pham, V. K., & Duong, N. T. (2025). Understanding M-learning App Adoption: An Integrated Model for College Students in Vietnam. *Interactive Learning Environments*, 1–23. <https://doi.org/10.1080/10494820.2025.2488144>
- Pratama, A. R. (2021). Fun First, Useful Later: Mobile Learning Acceptance among Secondary School Students in Indonesia. *Education and Information Technologies*, 26(2), 1737-1753. <https://doi.org/10.1007/s10639-020-10334-w>
- Rahmayanti, P. L. D., Widagda, I. G. N. J. A., Yasa, N. N. K., Giantari, I. G. A. K., Martaleni, M., Sakti, D., & Anggreni, P. (2021). Integration of Technology Acceptance Model and Theory of Reasoned Action in Predicting E-Wallet Continuous Usage Intentions. *International Journal of Data and Network Science*, 5(4), 649-658. <https://doi.org/10.5267/j.ijdns.2021.8.002>
- Rasit, N., & Ismail, Z. (2024). [MS] Hubungan antara Strategi Pembelajaran dan Hasil Pembelajaran Bahasa Arab dalam Kalangan Murid Sekolah Menengah Agama di Malaysia: The Relationship between Learning Strategies and Learning Outcomes of Arabic Language among Religious Secondary School Students in Malaysia. *Afaq Lughawiyah*, 2(2), 352-364.
- Ritonga, M., Febriani, S. R., Kustati, M., Khaef, E., Ritonga, A. W., & Yasmar, R. (2022). Duolingo: An Arabic Speaking Skills Learning Platform for Andragogy Education. *Education Research International*, 2022(1), 7090752. <https://doi.org/10.1155/2022/7090752>
- Rizan, N. A. M., & Baharudin, H. (2021). Tahap Pengetahuan Kosa Kata dan Pencapaian Kemahiran Bertutur Bahasa Arab Pelajar di Sekolah Agama Bantuan Kerajaan (SABK) Selangor. In *3rd International Conference on Business Studies and Education (ICBE)* (Vol. 28).
- Sarzhanova, G., Otyynshiyeva, M., Tleuzhanova, G., Assanova, D., & Sadvakassova, A. (2023). Organizational, Technological, and Pedagogical Conditions for Differentiated Instruction of Teaching English as a Foreign Language. *International Journal of Education in Mathematics, Science, and Technology (IJEMST)*, 11(1), 74–95. <https://doi.org/10.46328/ijemst.2809>
- Shaffril, H. A. M., Ahmad, N., Samsuddin, S. F., Samah, A. A., & Hamdan, M. E. (2020). Systematic Literature Review on Adaptation Towards Climate Change Impacts among Indigenous People in the Asia Pacific Regions. *Journal of Cleaner Production*, 258, 120595. <https://doi.org/10.1016/j.jclepro.2020.120595>
- Saja, I., Ramli, S. M., Sopian, A., & Abdul Razak, A. Q. (2021). The Use of Youtube in Arabic Speaking Skills during Open and Distance Learning (ODL). *J. Sains Sos. Dan Kemanus*, 18, 188-202.
- Silva, F. A., Shojaei, A. S., & Barbosa, B. (2023). Chatbot-Based Services: A Study on Customers' Reuse Intention. *Journal of Theoretical and Applied Electronic Commerce Research*, 18(1), 457-474. <https://doi.org/10.3390/jtaer18010024>
- Syahrani, D. P., & Yasa, N. K. (2022). The Role of Trust as Mediation between Perceived Usefulness and Perceived Ease of Use on Repurchase Intention. *European Journal of Development Studies*, 2(3), 36-40. <https://doi.org/10.24018/ejdevelop.2022.2.3.91>

- Tajik, A. (2025). Gamified and Non-Gamified AI Tools in Enhancing EFL Listening Comprehension: An Analysis of Duolingo and Replika's Impact on Engagement, Motivation, and Learning Outcome. 20 February 2025, PREPRINT (Version 1) available at Research Square. <https://doi.org/10.21203/rs.3.rs-6032009/v1>.
- Tai'Tullah, A. S., & Daud, W. A. A. W. (2025). Tahap Kemahiran Komunikasi, Kemahiran Keusahawanan dan Kemenjadian Pelajar Bahasa Arab di Universiti Awam Pantai Timur. *International Online Journal of Language, Communication, and Humanities*, 8(1), 94-107.
- Usup, U., & Purwaningsih, D. I. (2024). Analysis of the Impact of Social Media as a Learning Tool in Language Subjects. *Journal of Computer Science Advancements*, 2(4), 231-243. <https://doi.org/10.70177/jsca.v2i4.1324>
- Wang, F. (2021). Analysis of an Online English Teaching Model Application Based on Improved Multiorganizational Particle Population Optimization Algorithm. *Computational Intelligence and Neuroscience*, 2021(1), 6232987. <https://doi.org/10.1155/2021/6232987>
- Whittemore, R., & Knafl, K. (2005). The integrative review: updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
- Wilson, J. (2014). *Essentials of business research: A guide to doing your research project*. London, UK: Sage.
- Wulyani, A. N., Sata, M. R. I. M., & Rusdin, D. (2024). Overcoming challenges: Indonesian EFL teachers' strategies for using Moodle in high schools. *Social Sciences & Humanities Open*, 10, 101175.
- Yasa, G. A., Utami, I. L. P., & Agustini, D. A. E. (2024). Developing Infographics of Cakeapp-Based Teaching Speaking Ideas for Tourism Vocational High School English Teacher in 11th Grade at SMK Negeri 2 Singaraja. *Lingua Scientia*, 114-128.
- Zahira, K., Amna Zahid, C. H., & Munir, S. (2024). Media Influence on English Language Proficiency: A Study on ESL Learners Of Sialkot, Pakistan. *Journal of Applied Linguistics and TESOL (JALT)*, 7(4), 79–98.
- Zghoul, W. M., & Bataineh, R. F. (2024). Flipgrid: Unlocking the English-Speaking Potential of Jordanian Adolescent EFL Learners. *Journal of Information Technology*.
- Zhou, S. (2024). Gamifying Language Education: The Impact of Digital Game-Based Learning on Chinese EFL Learners. *Humanities and Social Sciences Communications*, 11(1), 1–14. Chinese EFL learners. *Humanities and Social Sciences Communications*, 11(1). <https://doi.org/10.1057/s41599-024-04073-3>

About the Contributor(s)

Roslizawati Saad, is a Doctor of Philosophy (PhD) candidate at the Faculty of Education, National University of Malaysia. She is an Arabic language teacher under the Ministry of Education Malaysia (KPM) and has served as an Arabic language teacher under the KPM for 17 years. Her research areas include teaching and learning Arabic.

Email: p121264@siswa.ukm.edu.my

ORCID: <http://orcid.org/0009-0004-8748-2248>

Harun Baharudin, PhD, is an Associate Professor at the Centre for Educational Diversity, Faculty of Education, Universiti Kebangsaan Malaysia (UKM). He also serves as the Chair of the Centre for Educational Diversity, Faculty of Education, UKM. His field of expertise is Arabic Language Education. He has 15 years of experience as a lecturer at the Faculty of Education, UKM.

Email: harunbaharudin@ukm.edu.my

ORCID: <http://orcid.org/0000-0002-6729-0044>

Nik Mohd Rahimi Nik Yusoff, Prof. Dr. Nik Mohd Rahimi Nik Yusoff is a full professor at the National University of Malaysia, Faculty of Education. He is a Professor of Arabic Language Education and Curriculum at the Centre for Educational Diversity Studies, Faculty of Education. Specializing in language education, educational psychology, and curriculum development, Prof. Dr. Nik Mohd Rahimi has over 25 years of academic experience and has held various academic and leadership roles, including principal investigator for numerous national and international research projects.

Email: nik@ukm.edu.my

ORCID: <http://orcid.org/0000-0003-0605-4010>

Publisher's Note: *The opinions, statements, and data presented in all publications are solely those of the individual author(s) and contributors and do not reflect the views of Universitepark, EDUPIJ, and/or the editor(s). Universitepark, the Journal, and/or the editor(s) accept no responsibility for any harm or damage to persons or property arising from the use of ideas, methods, instructions, or products mentioned in the content.*
