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The Application and Impact of Technology-Enhanced Pedagogy in Arabic Language Education: A Scoping Review

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Abstract
The purpose of this scoping review is to analyze how Arabic language education with technology-enhanced pedagogy has developed, looking not only at its integration, application and utilization but also the impact of current digital technologies. The review follows Arksey and O'Malley's methodology. It is a scoping analysis of empirical researches indexed on Scopus and Web of Science with the descriptor period 2020–2025; no eligible study was found for 2020–2021, so that the final sample consisted in 13 studies published from 2022 to 2025. According to the review, AI-based applications, gamified learning environments, reality and immersive technology development, online learning systems corpora as a resource for Arabic language skills such as increased student engagement and instructional material flexibility. Their realisation depends on digital skills of teachers, the readiness of educational establishments and the synchronisation ICT tools with pedagogical targets. In addition, the review reveals persistent literature voids such as little attention devoted to language-related idiosyncrasies in Arabic, very little information about implementation difficulties and a dearth of locally adapted school-based research. Through qualitative synthesis of the evidence and discussions about methodological weaknesses, theoretical gaps are identified by this review and highlighted as providing a rather immediate call for context-sensitive research able to inform sustainable adoption of technology and pedagogically relevant innovation in Arabic teaching and learning contexts.
Keywords: Scoping Review; Technology-Enhanced Pedagogy; Arabic Language Education; Digital Literacy

INTRODUCTION
In the new education ecosystem we are seeing today, changes are taking place faster than ever.This acceleration is a hallmark of digital technology and is reshaping how transition to new forms of learning occurs. Effective language teaching now relies increasingly on the successful integration of technology (Jalaluddin, 2025). Teachers need to individualize instruction, increase student engagement, utilize AI-driven tools, navigate online platforms and build digital literacy for a range of students (Jiang 2025; Rebolledo & González 2023). The shift towards teaching with technology mirrors larger worldwide changes in the ways that we communicate, share information and expectations of work. Digital literacy is now an essential basic skill in education. Recent publications have suggested that technology is not supplemental but instead provides a basis for innovative ways of teaching and learning language in more personal, interactive, and data-rich environments (R. Zhang & Zou, 2020).

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Of these several technologies have been particularly influential. Learning systems utilising AI, gamified platforms, immersive technologies like AR/VR, and mobile Apps are tools contributing to better language performance and learners' motivation (Hanem 2025; Tareq & Andreas 2022). Studies show that AI-generated feedback enhances the accuracy of reading and listening comprehension (Hijriyah et al., 2025). Earlier forms of question-generation technology, which were often limited and inconsistent, have been repeatedly examined and refined in past research. Motivation and deeper engagement with the content are increased by gamified environments (Khanchai et al. 2025; Zainudin & Huda 2024). In the context of immersive technologies, these enable an authentic exposure to and practical experience beyond teaching within established learning environments. Together, these tools are changing the ways we learn and teach language skills at all levels of education.

Empirical studies highlight the importance of teachers' digital readiness and the necessity for adequate support across multiple systems. Teachers are challenged to use technology in ways that go beyond treating it as a simple tool or device (Anane, 2024). Instructionally relevant technology use enhances the quality of teaching, supports more effective learning strategies, and, in some cases, contributes to measurable improvements in student performance and engagement (Raswan et al., 2025). Research suggests that institutions with strong digital ecosystems, professional development provision and supportive policies are better able to use technology-enhanced pedagogy (Wafa' et al. 2025). However, considerations about equity, AI ethics and the sustainability of digital infrastructure need to be critically examined further.

At present, there is now evidence that technology-enhanced pedagogy can foster language competences and changes in instructional practices, as well as promote student engagement. However, differences in technology adoption, teaching strategies, and learning context point to the need for further exploration (Samsul et al. 2025). Long-term effects, especially in heterogeneous learning situations, are yet to be determined. Further research will contribute to more thoughtful, impactful, and just applications of technology in language study. Despite the global trend towards technology-enhanced language teaching, this approach has not yet been systematically examined in relation to the distinctive linguistic and pedagogical characteristics of Arabic. Arabic presents particular challenges and opportunities for technology integration due to features such as its script directionality, morphological richness, and diglossic nature. To date, empirically validated studies that focus specifically on technology-enhanced pedagogy in Arabic language education appear to be limited. This article addresses this gap by focusing on the unique contributions, challenges, and pedagogical possibilities offered by digital tools in supporting the teaching and learning of Arabic.

To better understand the landscape of technology-enhanced pedagogy in Arabic language teaching, it is useful to first examine how various digital tools and innovations have influenced general language instruction and pedagogical approaches. Digital and information technology have completely changed the way languages are being learned, through more interaction, individualised learning and knowledge driven course design (Zhang & Yang 2025). With the growing presence of AI-driven applications, gamification platforms, mobile learning devices and immersive technologies in classrooms on one hand and the education taxonomies that transform how we teach and learn digitally on other, educators have to reconsider traditional pedagogical models to fit into contemporary digital practices (Väätäjä & Ruokamo, 2021; Y. Zhang & Miao, 2025; Zou et al.,

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2025). The intersection of these pedagogical and technologically mediated practices has therefore been a fertile space for research, with research suggesting their potential to enhance student engagement, promote more effective language learning outcomes and open up access to flexible modes of learning (Robillos, 2023; Wei, 2023). However, the quantity and form of these effects directly affect language, instructional level and teaching situation (Zelenskyi et al., 2020). Despite the many studies that have been carried out on digital enhancement of English, Mandarin and Spanish language acquisition (Pérez-Jorge et al., 2025; Wang et al., 2024), little research has been conducted on the application of these advances in Arabic language instruction (Faiqoh et.al 2025). Instead, the teaching and learning of Arabic carry specific linguistic, cultural and pedagogical elements that impact technology-enhanced methodologies. These factors include script directionality (unique to each respective region), morphological complexity and diglossia, all of which may have a significant impact on how students interact with digital tools (Alrwaita et.al 2022). It is of interest to know how technology supports or hinders Arabic language learning to pave the way in making instructional design decisions and advances/innovations (Ghani et al., 2022). While the interest in digital transformation is on the rise, there still exists limited evidence-based information about how to conceptualize, implement and evaluate technology enhanced pedagogy within the field of Arabic language education (Nufus & Azis, 2025). This lack highlights the role for a systematic review of the literature to elucidate current understanding, determine uncertainty and guide future research (Hady et al., 2025; Ibrahim et al., 2024).

In response to this absence, the current article performs a scoping review of literature on technology-enhanced pedagogy in the teaching of Arabic language. The review categorizes the technologies used by these studies, the pedagogical design strategies they apply, and the learning outcomes they report, along with trending themes in current research. Through providing an extensive survey of this developing field, the review intends to facilitate evidence-based teaching and learning, to update teacher education and to shape innovation in digital Arabic Language instruction in the future.

METHOD

A scoping review is an evidence synthesis that aims to identify and map the extent of available systematic evidence on a topic, field, concept, or issue (Munn et al., 2022). This is considered useful in case when the literature has not been reviewed comprehensively, and would be too heterogenous for systematic review (Peters et al., 2015). Scoping reviews, systematic reviews and bibliometric studies are different type of literature review techniques aimed at specific purposes using a unique method (Munn et al., 2022; Passas, 2024). Scoping reviews are used to systematically map the literature in a broad area to gain an overview of the given topic and facilitate further research through identifying gaps, resolving disagreements or as evidence for literature review work (Levac et al., 2010). They are commonly used prior to systematic reviews or for generating hypotheses (Peters et al., 2021). Systematic reviews concentrate on particular clinical or research issues (Smith et al., 2011). They employ rigorous, transparent methods to reduce bias, often following a structure (such as PICO: Population, Intervention, Comparison Intervention or Control Comparator, Outcome) (Brignardello-Petersen et.al 2024). They seek to obtain comparable results and valid conclusions on which evidence-based policy decisions may be made. On the other hand, bibliometric analysis is based on quantitative comparisons of

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bibliographic data (Donthu et al., 2021). It uncovers the characteristics of publication, research focus, cooperative network and influence in a discipline. Bibliometric work does not compile research results, but rather offers a picture of the structure and long term growth of the scientific literature (Passas, 2024).

This original research article uses a six-step approach developed by Arksey & O'Malley (2005) and is explained step-by-step throughout the subsequent sections: stage 1: The scoping review was informed by three main research questions. The first question is: What does the literature say about tech-supported pedagogical interventions in Arabic language instruction? The second explores digital tools and technology-based practices and pedagogical approaches in teaching Arabic. Finally, the third examines technology and pedagogy in teaching Arabic and its influence on learning outcomes as well as suggestions for future research based upon gaps or limitations. Step 2: Two databases, namely Scopus and Web of Science, were selected as primary sources in the review because of their wide coverage and good indexing as well as their methodological soundness (Singh et al., 2020). Both comprise leading education, applied linguistics and instructional technology journals as well as Arabic journals of language studies. Scopus is broader view in terms of international scope and varied subject, Web of Science has stringent indexing and extensive citation tracking (Baas et al., 2020). The use of both improves the odds in favor of identifying different designs and global views, lessens bias, and boosts evidence validity. The search covered publications from 2020 to 2025; however, the final set of eligible studies was limited to articles published between 2022 and 2025.

Step 3: Inclusion materials were further analysed according to pre-defined operational indicators. Only education publications were included. Only peer-reviewed research articles were included so the methodology was more robust (Stanley & Robertson, 2024). No conference papers, book chapters, reviews or books were identified. The publication included only English-based literature from 2020 to 2025 (Figure 1); however, no eligible studies were indentified for 2020 and 2021, and the final sample comprised 13 empirical studies published between 2022 and 2025. In light of the limited number of empirically validated studies on technology-enhanced pedagogy in Arabic language learning, evidence from related domains (English, French and Malay) was included in this review. They provide conceptually transferable lessons from established models of learning, pedagogical design and technological tools. Their incorporation follows the norm in scoping review methodology to include diverse evidence sources in order to enable a comprehensive mapping of trends. Step 4: Data from eligible studies were extracted after a screening process utilizing a structured charting form to ensure consistency in the analysis (Büchter et.al 2020). The variables selected were authorship, year of publication, country and context for research, study design methodological approach (conceptual or theoretical), characteristics of the participants, technology type to intervene with special populations, pedagogical tools used by the authors and reported outcomes. The inclusion of variables such as technology type in this review facilitated the identification of differences between specific digital platforms and tools, in addition to modes by which these were integrated within studies, whereas country and educational context assisted in better understanding how practices with technology varied across countries or institutional types (Chugh et al., 2023). Adoption of a standardised charting between knowledge synthesis studies increased transparency and facilitated direct comparison across diverse sets of studies to inform an organised understanding of emerging

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pedagogical trends, technology-integration fads and methodological differences in the field (DelaTorre-Diaz et. al 2025).

Step 5: A thematic synthesis was performed to examine the extracted data, and common pedagogical themes, technology integration approaches and methodological preferences across included studies were identified (Bizami et. al 2022). The results were presented in an integrated way into understandable thematic groups of findings based on narrative description, by descriptive table or other visual form (eg conceptual map/chart). A comprehensive description of the scope, distribution, and trajectory of technology-enhanced pedagogy research investigation was made possible through this analysis especially for Arabic language teaching. Step 6 (Output): Interpretation of findings in relation to review aims The discussion interprets the findings in light of the review aims and explains how existing evidence advances understanding of technology-enhanced pedagogy in Arabic language education. Since the field is in its early stages, the conclusion identifies methodological and conceptual shortcomings within studies included in the review and offers tailored suggestions for future research on digital and interactive teaching. The final paper synthesizes the main findings, contributions and future potentials of technology integrated pedagogy in educational settings.

RESULTS AND DISCUSSION

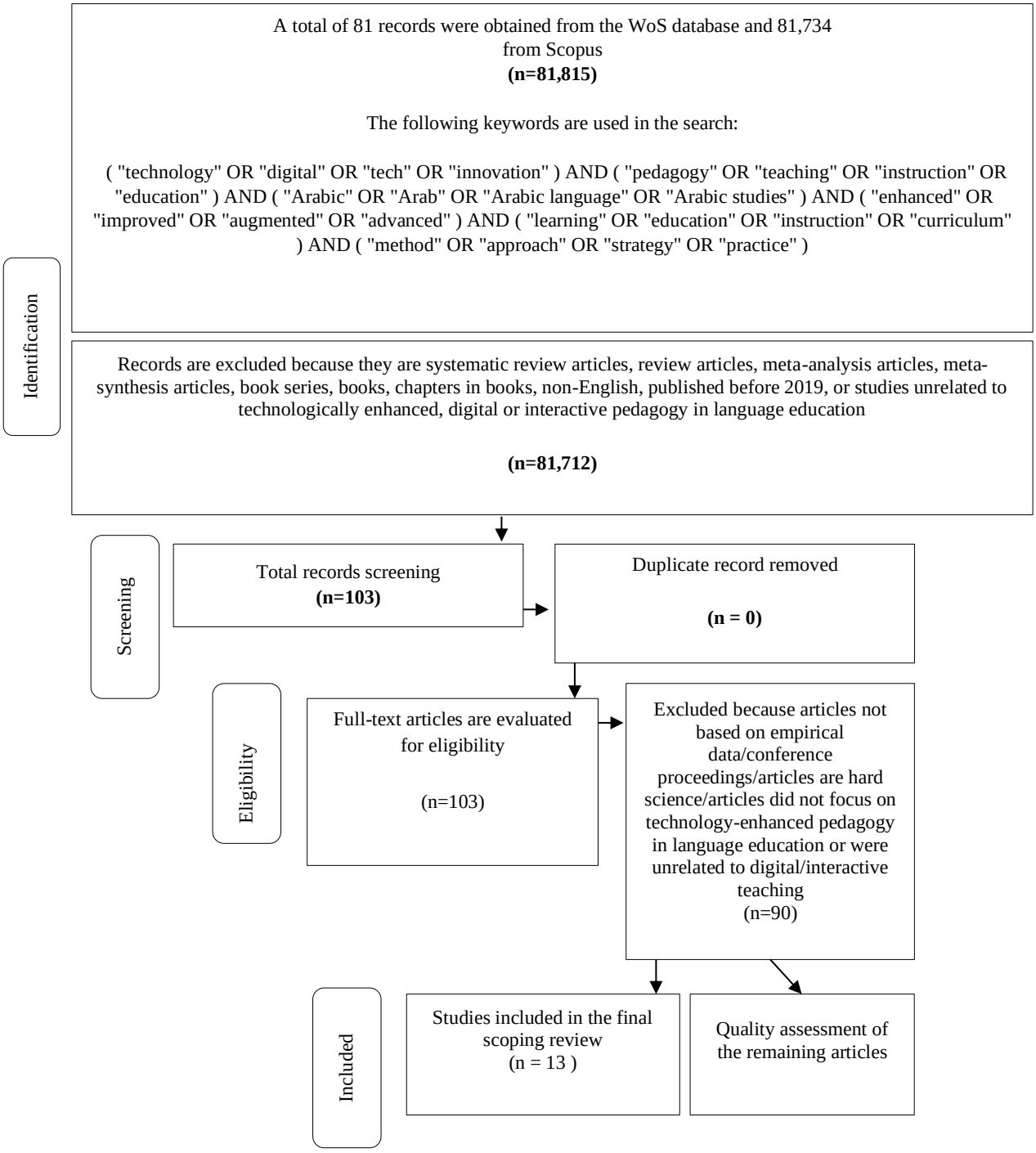
Based on the six-stage framework described above, the following section presents the outcomes of the scoping review, highlighting the quantity, characteristics, and themes of the selected studies. From searches of databases (Web of Science and Scopus) we found 81,815 references. After the implementation of the first set of exclusion criteria, 81,712 records were left. These criteria led to the exclusion of systematic reviews, conference or review papers, meta-analyses, book chapters, non-English publications, research articles published before 2019 and studies not related to technology-enhanced/digital/interactive methods in language education. Following screening for empirical relevance, 103 papers were retained and reviewed. There is no duplications at this time. After full text review, 90 articles were removed for failing as empirically based studies, hard science categorization or irrelevant to technology-enhanced or interactive pedagogical practices. In the end, 13 articles were accepted into the scoping review. All 13 of these included articles were published between 2022 and 2025; no eligible studies were identified for 2020–2021 within the predefined 2020–2025 search window.We then assessed the quality of these retained article as shown in Figure 1.

The criteria for selecting articles for this scoping review were developed to help ensure the relevance, quality and methodological rigor of the included literature (Peters et al., 2020). Review included only articles published in a peer review journal and did not include book chapters or conference papers which would meet scientific guidelines. All forms of empirical studies qualitative, quantitative and mixed methods and their distinct and complementary approaches to the technology-enhanced pedagogy in language education were taken into consideration (Zolfaghari et al., 2025). Qualitative research allows for an in-depth examination of teacher and student experiences (Liu et. al 2023), quantitative data generates assessable and comparable information (Shadiev & Yang, 2020), mixed-methods research combines both methods to provide a full picture (Mulyadi et al., 2023). Only English language studies were considered to ensure uniform interpretation and coherency in synthesizing trends. Taken together, these criteria aimed

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to support the inclusion of high-quality, relevant and methodologically rigorous evidence pertinent to the study's questions.

Figure 1. Flow Diagram Of The Research Selection Process Using the Preferred Reporting Items for Systematic Review (PRISMA) adapted from the study by Moher et al. (2015)



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Mixed-methods studies demonstrated stronger analytical rigor through the triangulation of quantitative and qualitative data, enabling more contextually grounded interpretations of learning outcomes. In contrast, studies relying predominantly on self-reported measures exhibited weaker methodological robustness; therefore, effectiveness claims based on short-term interventions and limited sample sizes should be interpreted with caution. English was chosen as the main language of review in order to be consistent and to have access totop-quality studies from international sources. Only empirical research studies were included in the review as they are better conceptualized and transparent regarding their methodological structure, unlike non-empirical (e.g., proceedings or concept papers). Such a scope allowed the construction of sound evidence about the efficacy of technology-enhanced pedagogy in language-learning. Only empirical papers published in last five years were selected so that this review would reflect latest developments and practice in technology enhanced learning and teaching. Limiting the timeframe to recent publications also enabled us to include research that has reached methodological adulthood and relationship with the new digital age in language education.

Table 1. The Outcomes Of The Scoping Review, Highlighting The Quantity, Characteristics, And Themes

Publication / Location	Variables/Constructs	The Impact of Technology-Enhanced Pedagogy	Sub-Theme	Theme
Silor & Silor (2025)	AI-based reading tools; Reading comprehension	AI reading platforms significantly improve students' understanding and motivation.	Reading Comprehension	AI-Assisted Language Learning
Hazaymeh et al. (2025)	AI listening apps; listening achievements; Attitude	AI listening tools lead to significant gains in listening performance and positive student attitudes.	Listening Skills	AI-Enhanced Pedagogy
Khanchai et al. (2025))	Gamification digital literacy; Comparison is not gamification	Gamification improves digital literacy and student engagement more effectively than traditional methods.	Gamification	Game-Based Learning
Susilawati et al. (2025)	Use of EdTech; Internationalization strategy	Educational technology strengthens the internationalization capacity and teaching quality in Islamic universities.	Technology Integration	Digital Transformation in Higher Education
Irfan & Arifin (2025)	Gamification language apps; Motivation; Involvement	Gamification learning significantly increases motivation, fun and participation in language learning.	Student Motivation	Game-Based Language Pedagogy
Hijriyah et al. (2025)	SUNO. AI; listen to Arabic; adaptive feedback	AI adaptive media improves Arabic listening skills with a strong post-test improvement.	Adaptive Listening Practice	AI-Based Arabic Learning
Majeed & Ahmad (2025)	the use of AI; digital efficiency; Informal Learning	Informal digital learning predicts teacher functional	Teachers' Digital Competence	Teachers' Readiness for Educational Technology

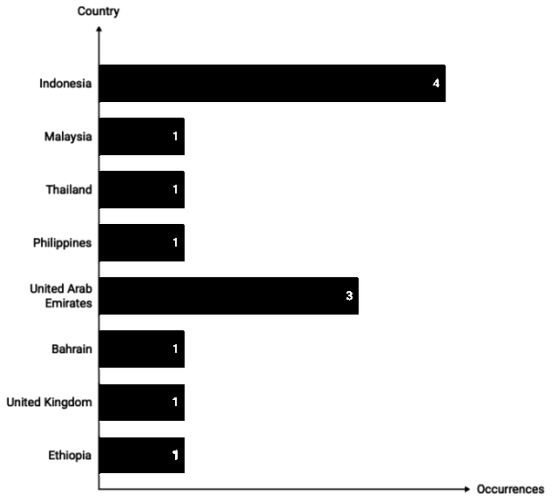
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		efficiency; The use of AI remains underutilized.		
Anane (2024)	"Kahoot!" Involvement; online French learning	Use of Kahoot! maintaining high engagement and positive perceptions of online learning.	Game-Based Engagement	Gamification Pedagogy
Asratie et.al (2023)	Talking technology (YouGlish, FORVO, OALD)	Technology-supported speech instruction improves fluency, coherence, vocabulary, grammar, and pronunciation.	Speaking Performances	Technology-Enhanced Language Skills
El-Farahaty (2025)	Corpus tools; ChatGPT; Legal Translation Pedagogy	AI + corpora enhances translation teaching through authentic data and interactive tasks.	Corpus & AI Integration	AI-Supported Instructional Design
Ghanem et.al (2025)	Smart Education Index; digital infrastructure; pedagogy	Propose a Smart Education Index to monitor digital transformation in higher education.	Smart Education Indicators	Smart & Sustainable Education
Mohamed & Sicklinger (2022)	VR/AR curriculum; Design education	The VR/AR curriculum enhances immersive learning, market readiness, and applied design skills.	Immersive technology	New Technologies Emerging in Education
Raswan et al. (2025)	Satisfaction; self-efficacy; Zoom & SPACE LMS	High self-satisfaction and effectiveness; students prefer Zoom but have limited LMS literacy.	Self-Satisfaction & Effectiveness	Effectiveness of Online/Distance Learning

Countries represented in this scoping review are illustrated in figure 2. The study of technology- supported pedagogy spanned eight countries. Indonesia contributed four studies. The United Arab Emirates gave away three. One plane came from each of Malaysia, Thailand, the Philippines, Bahrain and the UK. This coverage indicates further research efforts in South East Asia and West Asia than other regions.

Figure 2. Number of Research By Country

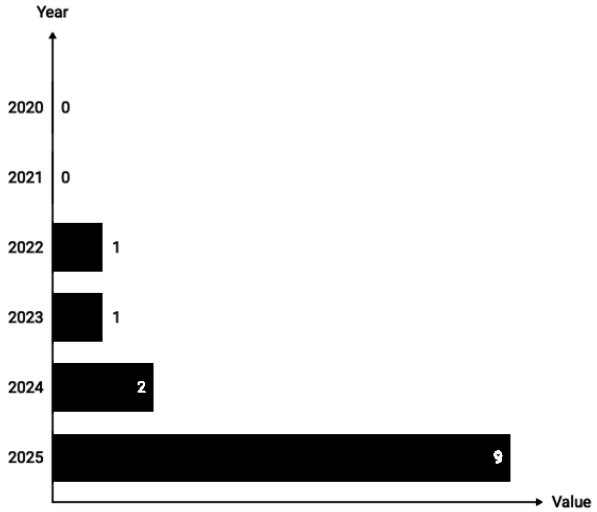


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The annual distribution of publications in this scope review is shown in Figure 3. No pertinent studies were published in 2020 or 2021. The publication process started with a study from 2022 and another from 2023. Afterwards, there were two publications on 2024 then a substantially higher number of nine in 2025 showed development of attention to research about technology enhanced pedagogy.

Figure 3. Year of publication in the WoS and Scopus databases



The results of this exercise address a third research question in that they describe the general nature of the scientific literature in this area. The findings suggest that studies on TEP have been carried out in different countries, including developing and developed environments. But there have only been a few relevant publications, and trends over time indicate that this is still an early phase in the evolution of this line of inquiry. Scientific interest started to rise only in 2022, increasing modestly through 2023 and 2024, before skyrocketing in 2025. This trajectory indicates an increasing acceptance for technology-mediated teaching and learning activities but its empirical underpinnings are still in infancy. In contrast to the broader technology in education literature, there are fewer studies on language or teacher centred pedagogy; calling for more research into teachers' practices and further dimensions of pedagogical and organisational practice to extend current understanding.

Technology-enhanced pedagogy is increasingly integrated in language education, and the studies under the review are indicative of consistent gains along cognitive, affective and institutional levels. AI-powered tools greatly enhance learners' reading, listening and translation skills as well as motivation and task participation (Silor & Silor, 2025; Hazaymeh et al., 2025; El-Farahaty, 2025). AI assisted simulation models such as SUNO. AI expedite listening improvement with individualized feedback, making AI an essential tool in differentiated instruction (Hijriyah et al., 2025). Gamification also has strong motivation effects which boost participation, digital literacy and enjoyment beyond the simple pedagogies (Anane, 2024; Irfan & Arifin, 2025; Khanchai et al., 2025). At the institutional level the implementation of digital transformation enhance internationalisation portfolios and pedagocial quality in education, especially Islamic higher education (Susilawati et al., 2025). Tools such as the Smart Education Index also depict how governance, infrastructure and pedagogical innovation are interwoven in

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ways that propel systemic transformation (Ghanem et al., 2025). Newly developed technologies such as VR/AR and immersive learning play a role in the enhancement of applied skills and readiness for improved instructional design (Mohamed & Sicklinger, 2022).

Teacher-related results further support the importance of teacher preparedness in facilitating successful technology integration. Casual digital learning reinforces teachers' digital competency, however, use of AI tools is still varying in different contexts (Majeed & Ahmad, 2025). Online learning environments can go beyond learners' satisfaction, confidence and self-efficacy also with low LMS literacy (Raswan et al., 2025). Taken together, the results demonstrate that TEP promotes teaching practices, linguistic learning results and enablement factors towards adaptive feedback, motivation, engagement and pedagogic novelty (Asratie et al., 2023; Hazaymeh et al., 2025).

In general, technology-assisted learning enhances linguistic performance, participation and institution readiness. Yet, the evidence remains piecemeal in nature; differing pedagogical models, contextual preparation and theoretical conceptualization of technology uptake contribute towards this. These lacunae demand more nuanced and context-responsive research on how digital tools work in varied linguistic, cultural and institutional contexts.

Figure 4. How Technology Tools And Platforms Function As Teaching Processes That Shape Language Learning Outcomes



Several methodological and conceptual limitations attend to this scoping review. First, we considered only Scopus and Web of Science for the review. Both databases are respected for their scientific rigor (Mongeon & Paul-Hus, 2015). Nonetheless, such searches restrict the evidence available. Database searching (e.g., ERIC, SpringerLink, ProQuest, Google Scholar) may also bring in studies from broader educational settings. This is particularly relevant for research on emerging digital tools or local technology innovations for language education. In the future versions it would be good to refer more databases on a wider and global technology-enhanced pedagogical mapping.

Second, the majority of studies included were based on qualitative or mixed methods. These methodologies allow me to know the student perspective, practice of teachers and the context. Yet they do not have statistical power either to generalize findings or to demonstrate causation. As digital processes and AI capabilities become more sophisticated, it would be beneficial to utilize stronger quantitative measures in future work. Higher-resolution evidence for such conclusions can come from experimental designs, structural equation modeling, learning analysis and AI data detection (Mohseni et al. 2024; Zellmer-Bruhn et.al 2016; Zyphur et.al 2022).

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These approaches can also inform how technologies influence learning impacts. Other potential limitations have to do with the attention given to the subject in current research. Existing work revolves mainly around short-term results such as understanding, speech rate, interest or engagement. There are less research into the long-term changes (Blau & Inbal-Shamir, 2016), the preparedness of teachers (Velander et al., 2023), ethical aspects related to AI usage (Nguyen et al., 2022) and sustainability of digital infrastructure (Trevisan et al., 2023). Future research ought to go beyond intervention outcomes. A larger study is necessary to comprehend how curriculum design, assessment, institutional policies and teachers' professional identity are being changed by technology. It is the literature review process itself that must be transparent and meticulous. Future research might benefit from systematic review protocols in improving both the synthesis and evaluation of evidence (Butler et.al 2016). Both systematic and mixed-methods study design may integrate qualitative and quantitative results (Fàbregues et al., 2023). This method exposes more characteristic patterns of comparison between the technologies. It likewise enriches theoretical generalizations and reinforces pedagogical implications for technology-integrated language education. By expanding the methodological approach, we intend to contribute to an evidence base and facilitate interdisciplinary discussion on digital, AI-driven and interactive learning practices.

This is a scoping study considering technology-enhanced pedagogy in language education. The study provides an integration of empirical findings from different environments for the theoretical explanation of AI-supported learning environment (Hazaymeh et al., 2025; Silor & Silor, 2025), gamified instruction (Irfan & Arifin, 2025), immersive technologies (Mohamed & Sicklinger, 2022) and online learning platforms. The emerging themes demonstrate the impact of digital innovations on instructional design, student engagement and educator professional practices (El-Farahaty, 2025; Khanchai et al., 2025; Majeed & Ahmad, 2025; Susilawati et al., 2025). These results highlight the importance of pedagogical models that posit technology at its core, influencing learning processes, outcomes and classroom settings.

The results suggest that teachers and institutions should focus on optimal intergration of digital tools as a core aspect of contemporary language learning. In order to accomplish this, we need a consistent investment in teacher readiness skill and digital infrastructure. Increasingly common AI-enhanced feedback, adaptive learning pathways and gamified learning enable educators to cultivate the skills needed to combine tools with curriculum goals and the needs of a range of learners. Policy innovations must create equal means of access and meaningful pathways for professional development, if technology is to be effectively integrated. This review also has implications in terms of pedagogy beyond the immediate focusing on further research needed to advance technology-enhanced language education. Implications for further exploring long term effects of immersive technologies on AI-mediated instruction and assessment practices, as well within digital ecosystems that support culturally and linguistically diverse learners are discussed. Such studies are important for developing an ethical, context-sensitive, and resilient infrastructure for the digitization of teaching and learning. Finally, this review proposes that the strategic integration of digital technologies, pedagogical innovation and institutional support can collectively redefine language education practices and drive sustainable educational transformation

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CONCLUSION

This scoping review shows that the role of technology-enhanced pedagogy is becoming more and more important in language education nowadays. The results suggest that digital technologies such as AI-empowered apps, gamified strategies, augmented reality (AR) tools and online language programs - enhance language learning achievement, learner motivation and engagement in a variety of educational environments while signalling the need for teachers' preparedness and institutions to facilitate their effective use. Nevertheless, research gaps persist with regard to the long-term impact of technology-enhanced instruction, the pedagogical implications of adaptive AI behaviors, as well as the formation of novel technology-centered teaching models. Therefore, further studies using sound and diverse research methodologies are necessary in order to develop a deeper understanding that can help facilitate sustainable and effective technology integration into our language classes.

ETHICAL APPROVAL

All participants received a comprehensive explanation regarding the research objectives and procedures, including their right to participate voluntarily. Participants were assured that participation was not mandatory and that they had the right to withdraw at any time during the study without negative consequences. To ensure the confidentiality of identities, all data obtained in this study underwent an anonymization process.

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CONFLICT OF INTEREST

The author(s) declare that there is no conflict of interest related to the research, authorship, or publication of this article.

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