



COMPUTER AIDED ARABIC LANGUAGE LEARNING: A SYSTEMATIC REVIEW OF TECHNOLOGY INTEGRATION AND EFFECTIVENESS

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Abstract

This study aims to systematically analyze Computer Aided Arabic Language Learning, evaluate its effectiveness based on empirical evidence, identify the underlying theoretical framework, and map the challenges and opportunities for its implementation. This study uses the Systematic Literature Review method by following the Preferred Reporting Items for Systematic Reviews and Meta Analyses guide. An analysis was conducted on 86 articles discussing Computer-Aided Arabic Learning from theoretical, technological, and implementive aspects published from 2015 to 2025. Key findings show that Computer Aided Arabic Learning, supported by frameworks such as Computer Assisted Language Learning and Technological Pedagogical Content Knowledge, significantly improves students' motivation and learning outcomes. Modern apps have evolved from just tools to adaptive tutors, characterized by the ability of apps to continuously analyze user learning data and personalize materials, difficulty levels, and feedback, rather than simply presenting the same static exercises for all students and often leveraging gamification and artificial intelligence to create personalized learning experiences. However, its effectiveness is limited by substantial challenges, including infrastructure gaps, educators' digital competence, limitations of formal evaluations for productive skills (speaking and writing), and the linguistic complexity of Arabic that has not been fully addressed by current technology. Computer-Aided Arabic Learning is a powerful pedagogical accelerator, but its potential can only be maximized through a strategic approach that integrates technology development with educator capacity building and the adoption of blended learning models. Synergy between

academic innovation and practical implementation is needed to overcome existing challenges and realize the full potential of technology in Arabic language education.

Keywords: *Arabic Language Learning, Adaptive Learning, Educational Technology.*

Abstrak

Penelitian ini bertujuan untuk menganalisis secara sistematis Pembelajaran Bahasa Arab Berbantuan Komputer, mengevaluasi efektivitasnya berdasarkan bukti empiris, mengidentifikasi kerangka teoretis yang mendasarinya, serta memetakan tantangan dan peluang implementasinya. Penelitian ini menggunakan metode Kajian Literatur Sistematis dengan mengikuti panduan *Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA)*. Analisis dilakukan terhadap 86 artikel yang membahas tentang Pembelajaran Bahasa Arab Berbantuan Komputer dari aspek teoretis, teknologi, dan implementatif yang dipublikasikan dari tahun 2015 sampai 2025. Temuan utama menunjukkan bahwa Pembelajaran Bahasa Arab Berbantuan Komputer, yang didukung oleh kerangka kerja seperti *Computer Assisted Language Learning (CALL)* dan *Technological Pedagogical Content Knowledge (TPACK)*, secara signifikan meningkatkan motivasi dan hasil belajar siswa. Aplikasi modern telah berevolusi dari hanya alat menjadi tutor adaptif, ditandai dengan kemampuan aplikasi untuk terus menganalisis data pembelajaran pengguna dan mempersonalisasi materi, tingkat kesulitan, dan umpan balik, daripada hanya menyajikan latihan statis yang sama untuk semua siswa dan sering memanfaatkan gamifikasi dan kecerdasan buatan untuk menciptakan pengalaman belajar yang dipersonalisasi. Namun, efektivitasnya dibatasi oleh tantangan substansial, termasuk kesenjangan infrastruktur, kompetensi digital pendidik, keterbatasan evaluasi formal untuk keterampilan produktif (berbicara dan menulis), dan kompleksitas linguistik bahasa Arab yang belum sepenuhnya teratasi oleh teknologi saat ini. Pembelajaran Bahasa Arab Berbantuan Komputer merupakan akselerator pedagogis yang kuat, namun potensinya hanya dapat dimaksimalkan melalui pendekatan strategis yang mengintegrasikan pengembangan teknologi dengan peningkatan kapasitas pendidik dan adopsi model pembelajaran campuran (*blended learning*). Diperlukan sinergi antara inovasi akademis dan implementasi praktis untuk mengatasi tantangan yang ada dan merealisasikan potensi penuh teknologi dalam pendidikan bahasa Arab.

Kata Kunci: *Pembelajaran Bahasa Arab, Pembelajaran Adaptif, Teknologi Pendidikan.*

INTRODUCTION

Arabic has a unique and strategic position in the socio-religious context in Indonesia. Far beyond its status as a foreign language,¹ Arabic is the language of the Qur'an and Hadith, two

¹ Syifaul Adhimah and Laili Mas Ulliyah Hasan, "The Transformation of Arabic Language Learning Through Gadgets by the Early Childhood Teacher Community," *Journal of Children's Education* 13, no. 1 (May 2024): 65–71, <https://doi.org/10.21831/jpa.v13i1.342>.

fundamental sources of Islamic teachings.² Consequently, the main motivation for the majority of Arabic learners in Indonesia is rooted in religious goals, namely to be able to study and understand Islamic teachings directly from their authentic sources.³ This urgency has encouraged the integration of Arabic as a compulsory subject at various levels of Islamic educational institutions. The ideal goal of this learning is the mastery of integral communicative competence, which is manifested in four language skills (*al-mahārāt al-lugawiyyah al-arba'ah*): listening (*istimā'*), speaking (*kalām*), reading (*qirā'ah*), and writing (*kitābah*).⁴

Although the goals of learning Arabic have been clearly defined, their implementation in many educational institutions still relies on conventional methods with fundamental limitations.⁵ The most dominant approach is the Grammar Translation Method, which focuses on analyzing grammatical rules (*naḥwu* and *ṣaraf*) and translating texts.⁶ While useful for studying classical religious texts, this method fails to develop active communicative competence.⁷ Students are often proficient in analyzing sentence structure theoretically but stutter when faced with real verbal communication situations, as listening and speaking skills are systematically neglected.⁸

This dominance of a teacher-centered approach, coupled with abstract material and repetitive memorization of rules, creates a negative cycle. The learning process becomes monotonous and boring, which directly contributes to the decline in students' interest and motivation.⁹ This low motivation is the convergence point for various problems: pedagogical weaknesses, a high cognitive load (such as the complexity of i'rab and unique phonemes without adequate visualization), and ultimately, suboptimal learning outcomes.¹⁰ This motivation crisis is the most fundamental challenge in conventional Arabic learning. The rapid development of Information and

² Vitri Angelina et al., "Problems of Understanding Nahwu Mahasantri Yayasan Munashoroh Indonesia (YMI) Pusat Ciputat Tangerang Selatan," *Lugatuna: Journal of Arabic Language Education & Science* 2, no. 1 (2023): 28–42.

³ Uril Bahruddin, "Constructivism in Maharah Kalam Lectures Using Instagram Media: Implementation, Problems and Student Perceptions in Indonesia," *Arabiyatuna: Arabic Journal* 5, no. 1 (2021): 127-140.

⁴ Evi Nurus Suroiyah and Dewi Anisatuz Zakiyah, "Perkembangan Bahasa Arab Di Indonesia," *Muhadasah: Jurnal Pendidikan Bahasa Arab* 3, no. 1 (June 2021): 60–69, <https://doi.org/10.51339/muhad.v3i1.302>.

⁵ Hasyim Asy'ari and Elok Rufaiqoh, "The Self-Efficacy of Arabic Teachers to Become Driving Teachers," *Ukazh: Journal of Arabic Studies* 4, no. 2 (2023): 849–55.

⁶ Hasyim Asy'ari and Elok Rufaiqoh, "LEARNING ARABIC LANGUAGE AT YAYASAN AL-QODIRI JEMBER (A Study of Analysis-Criticism of Arabic Language Learning Problems in the 4.0 Era at Madrasah Tsanawiyah and Madrasah Aliyah Al-Qodiri Jember)," *Lisan An Nathiq: Journal of Arabic Language and Education* 6, no. 1 (2024): 83–97.

⁷ Yuma Fardiya and Taufik Taufik, "Strategi Inovatif Dan Tantangan Yang Dihadapi Dalam Pembelajaran Kalam Bahasa Arab," *AL-WARAQAH Jurnal Pendidikan Bahasa Arab* 5, no. 2 (December 2024): 13–27, <https://doi.org/10.30863/awrq.v5i2.6544>.

⁸ dan farikh marzuki ammar Islamiyati, Dian, "Challenges and Solutions in Maharah Kalam Learning: A Qualitative Study in an Islamic Junior High School in Sidoarjo, Indonesia," *Indonesian Journal of Islamic Studies* 11, no. 2 (2023), <https://ijis.umsida.ac.id/index.php/ijis/article/view/1662/1959?download=pdf>.

⁹ Elok Rufaiqoh et al., "Jacob's Analytical Assessment in the Evaluation of Arabic Writing Skills at Madrasah Aliyah Negeri Program Keagamaan," *Alsinatuna* 9, no. 1 (2023): 29–40.

¹⁰ Taufik Taufik et al., "Learning Elements of Arabic Language (Mufradat and Qawaid) with the Application of Flashcard Learning Strategies in Class V of Madrasah Ibtidaiyah (MI)," *Diwan: Journal of Arabic Language and Literature* 15, no. 1 (2023): 58–73.

Communication Technology (ICT) offers innovative solutions to overcome these limitations.¹¹ The integration of ICT has shifted the paradigm from a teacher-centered to a learner-centered model.¹² This technology removes the physical and temporal boundaries of traditional classrooms, enabling "anytime, anywhere" learning and enriching the educational experience through dynamic and interactive multimedia content.

The results of a study conducted by M. Ali Ghufron and Fitri Nurdianingsih revealed that computer-based reverse classes have many advantages, such as stimulating student autonomy, improving the teaching and learning process, providing more time and input during face to face meetings, encouraging active learning, student learning responsibility, and collaboration between friends¹³. In addition, Reza in his research showed a positive effect of computer-based on student motivation. In addition, students' achievement also increased after computer-based intervention.¹⁴ Another view is seen from the change in students' positive attitudes towards technology supported learning activities and learning activities that contribute to the development of language skills.¹⁵ From previous research, this shows that Computer Aided Arabic emerges as a promising approach.

Computer Aided Arabic Learning is defined as the use of computer hardware and software to facilitate and enrich the process of teaching and learning Arabic.¹⁶ This approach directly targets the "motivation crisis" inherent in conventional methods. Presenting materials through creative, engaging, and interactive formats such as games, videos, and technology simulations has the potential to drastically increase student interest and engagement.¹⁷ More than that, Computer Aided Arabic Learning encourages learning autonomy, where students are no longer solely dependent on teachers as the only source of knowledge, but can access a wide range of resources independently.

¹¹ Xieling Chen, *Twenty-Five Years of Computer-Assisted Language Learning: A Topic Modeling Analysis*, n.d.

¹² Akbar Bahari, Sumei Wu, and Paul Ayres, "Improving Computer-Assisted Language Learning Through the Lens of Cognitive Load," *Educational Psychology Review* 35, no. 2 (May 2023): 53, <https://doi.org/10.1007/s10648-023-09764-y>.

¹³ M. Ali Ghufron and Fitri Nurdianingsih, "Flipped Classroom Method with Computer-Assisted Language Learning (CALL) in EFL Writing Class," *International Journal of Learning, Teaching and Educational Research* 20, no. 1 (January 2021): 120–41, <https://doi.org/10.26803/ijlter.20.1.7>.

¹⁴ Reza Anggriyashati Adara and Aridhotul Haqiyah, "Improving Indonesian EFL Learners' Motivation Through Computer Assisted Learning (CALL)," *Journal of English Language Studies* 6, no. 1 (March 2021): 110–21, <https://doi.org/10.30870/jels.v6i1.9119>.

¹⁵ Rustam Shadiev and Jiatian Yu, "Review of Research on Computer-Assisted Language Learning with a Focus on Intercultural Education," *Computer Assisted Language Learning* 37, no. 4 (May 2024): 841–71, <https://doi.org/10.1080/09588221.2022.2056616>.

¹⁶ Tantiana Isnaningsih, "Pengembangan Multimedia Pembelajaran Bahasa Arab Berbantuan Komputer Di SMA/SMK Muhammadiyah," Articles, *AN NUR: Jurnal Studi Islam* 7, no. 1 (February 2020): 78-105, <https://www.jurnalannur.ac.id/index.php/An-Nur/article/view/58>.

¹⁷ Almi Novita and Munawir Munawir, "Media Pembelajaran Bahasa Arab Berbasis Teknologi Informasi Komunikasi Pada Pembelajaran Daring Di Sekolah Dasar," *EDUKATIF: JURNAL ILMU PENDIDIKAN* 4, no. 1 (January 2022): 1378–86, <https://doi.org/10.31004/edukatif.v4i1.1947>.

Thus, technology is present as a promising catalyst to bridge the gap between the ideal goal of communicative mastery and the reality of practice in the field.

Although various applications and digital platforms for Arabic language learning have developed rapidly, there is still a lack of comprehensive research synthesis to systematically map the realm of Computer Aided Arabic Learning. Many existing studies are fragmented, focusing on specific applications or contexts without providing a holistic picture. Therefore, there is a need for a study that identifies, evaluates, and synthesizes the existing evidence regarding the theoretical framework, technological domain, effectiveness, and challenges of implementing Computer-Aided Arabic Language Learning.

Based on the identified gaps, this study is designed to develop a systematic theoretical framework for Computer-Assisted Arabic Language Learning (CALL) in the digital age. The research aims to analyze three key aspects: (1) the theoretical foundations and pedagogical innovations in CALL design, (2) the utilization patterns of applications, platforms, and digital media, and (3) the empirical effectiveness of CALL in improving motivation and learning outcomes, along with its implementation challenges. This research is considered urgent because prior studies remain fragmented spanning technology, pedagogy, and learning outcome evaluation and lack holistic integration. Through a systematic review, this study is expected to consolidate scattered findings, provide a conceptual guide for CALL development, and identify opportunities for further research toward more adaptive and learner-centered Arabic language learning.

METHOD

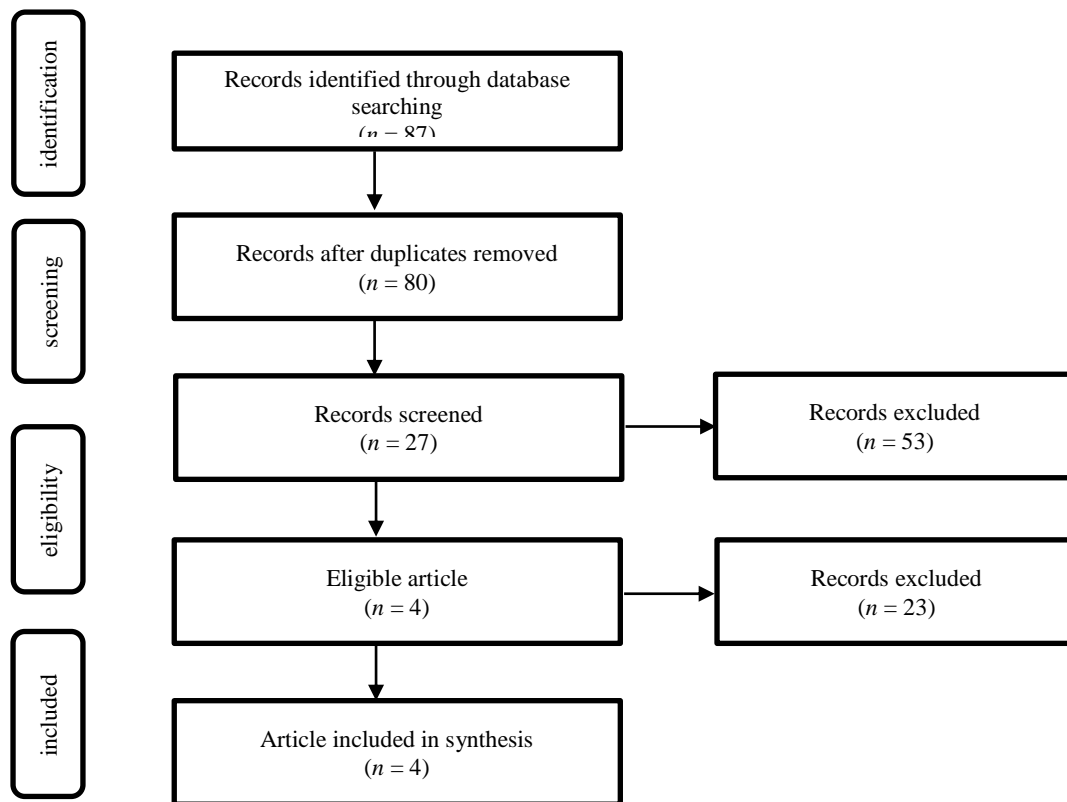
This study employs the Systematic Literature Review (SLR) method, guided by the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) framework. This approach ensures methodological rigor, transparency, and reproducibility. The choice of SLR is due to its capacity to comprehensively and impartially identify, evaluate, and synthesize all relevant research evidence. The SLR process will be carried out through four main stages: identification, screening, eligibility, and inclusion, which will be visually mapped using a PRISMA flow diagram. This systematic approach enables a structured gathering of evidence to address the core research questions regarding the transformation of Arabic language learning through educational technology, its effectiveness, and its future prospects.¹⁸

The review begins with a comprehensive search across major academic databases such as Scopus, Web of Science, ERIC, Google Scholar, as well as repositories of educational and learning

¹⁸ Matthew J. Page et al., *The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews*, Research Methods & Reporting, British Medical Journal Publishing Group, March 29, 2021, <https://doi.org/10.1136/bmj.n71>.

technology journals. Keywords will include combinations of terms such as: ("Arabic language learning" OR "Arabic acquisition") AND ("digital technology" OR "educational technology" OR "computer-assisted language learning" OR "mobile learning" OR "blended learning") AND ("effectiveness" OR "motivation" OR "learning outcomes") AND ("systematic review" OR "meta-analysis"). The publication timeframe is limited to the last 10 years (2015-2025) to ensure the relevance of findings to current technological contexts.¹⁹

Figure 1. PRISMA Flowchart



The search results with these keywords show 87 articles from the Scopus database, Web of Science, ERIC, Google Scholar. The second stage is to publish the same article, but since the search is only done from several databases, the same article is found, in this second stage the number becomes 80 articles. Then in the third stage, we re-screen the previously obtained articles by limiting the research subjects to only the categories of "Arabic language learning" or "Arabic acquisition" and "digital technology" or "educational technology". After that, we eliminated the categories of book reviews, editorial comments, conference proceedings, and review articles. The language of the article chosen in this study is only English language articles. By applying these

¹⁹ Barbara Kitchenham and Stuart M Charters, "Guidelines for Performing Systematic Literature Reviews in Software Engineering," ResearchGate, accessed September 16, 2025, https://www.researchgate.net/publication/302924724_Guidelines_for_performing_Systematic_Literature_Reviews_in_Software_Engineering.

criteria, there are 27 articles left. Then we continue the process of filtering this article by evaluating the articles, the evaluation is carried out by selecting articles or empirical publications from peer review journals and looking again at the relevance of the article to this research topic, then 4 articles are obtained. We then analyzed the articles further by paying attention to the titles, abstracts and discussions of the 4 articles. Finally, 4 articles were included for the next stage of study.

From the included studies, data on methodology, technological interventions, and findings are extracted. The evidence is analyzed thematically to identify key patterns regarding effectiveness, implementation challenges, and future prospects. This structured synthesis aims to provide consolidated, evidence-based insights for educators and policymakers in the field.

RESULT AND DISCUSSION

Integrative Theoretical Foundations in Computer Aided Language Learning

An in depth understanding of Computer Aided Arabic Learning requires an analysis of the underlying theoretical framework. This framework is not singular, but can be understood as a multi layered model that is interconnected, ranging from a shift in psychological paradigms at the macro level, pedagogical frameworks at the meso level, to cognitive processing theories at the micro level. The history of Computer Assisted Language Learning reflects a broader evolution in learning theory. The initial phase, known as Behavioristic CALL, was heavily influenced by the learning theory of Behaviorism.²⁰ In this paradigm, learning is seen as a mechanical process of habit formation through the Stimulus-Response-Reinforcement model.²¹ The computer, in its role as a "tutor", presents a drill-and-practice exercise designed to instill correct linguistic patterns through positive reinforcement (correct feedback) and negative reinforcement (error correction).

However, this approach has been criticized for oversimplifying the language acquisition process and ignoring internal mental processes. In response, there has been a shift towards Communicative and Integrative CALL, which is in line with the Cognitive Revolution in psychology.²² The Cognitivism paradigm views learners as active information processors, not passive receivers. The focus shifts from the accuracy of form to the use of language for meaningful communication.²³ In this phase, the role of computers evolves from being a mere "tutor" to a "tool" that empowers learners to explore, create, and communicate using the target language. An analysis of modern applications shows that this dichotomy between tools and tutors is increasingly blurred.

²⁰ Mark Warschauer and Deborah Healey, "Computers and Language Learning: An Overview," *Language Teaching* 31, no. 2 (April 1998): 57–71, <https://doi.org/10.1017/S0261444800012970>.

²¹ B. F. Skinner, *Verbal Behavior* (East Norwalk, CT, US: Appleton-Century-Crofts, 1957), 478, <https://doi.org/10.1037/11256-000>.

²² Warschauer and Healey, "Computers and Language Learning."

²³ Michael I. Posner, Patrick Bourke, and Ulric Neisser, "Cognitive Psychology," *The American Journal of Psychology* 105, no. 4 (1992): 621, <https://doi.org/10.2307/1422917>.

Advanced apps like Mondly,²⁴ for example, serve as "tutors" by presenting structured lessons and providing automated feedback through voice recognition, as well as as "tools" by providing dictionary and verb conjugations that can be accessed independently by users. This transformation signifies the maturation of CALL theory, where maximum effectiveness is achieved through a blend of structured guidance and learner autonomy.

If the evolution of CALL provides historical context, the Technological Pedagogical Content Knowledge (TPACK) framework provides practical guidance for educators at the meso level. TPACK is a framework that underscores the need to integrate three core knowledge domains: Content Knowledge (what is taught), Pedagogical Knowledge (how to teach), and Technology Knowledge (what tools are used).²⁵ TPACK's strength does not lie in each domain separately, but rather in the understanding of the complex interactions between the three.²⁶ Effective TPACK is not just about using technology for the sake of technology, but choosing and applying digital tools that are pedagogically appropriate to deliver specific content.²⁷ For example, an Arabic teacher who has a strong TPACK might choose a narrative app like Plotagon not because it's technologically advanced, but because it's pedagogically effective at practicing listening skills (*mahārah istimā'*) in an engaging way. Similarly, the use of video to facilitate conversation (*muḥādāṣah*) was chosen because the format inherently supports the pedagogical goal of practicing speaking skills (*mahārah kalām*) in a more authentic context.²⁸ As such, TPACK ensures that technology serves as an integral part of a coherent teaching strategy, not as a separate add-on.

At the micro level, the effectiveness of Computer Aided Arabic Learning can be explained through theories that model the workings of the human mind. Cognitive Load Theory (CLT) becomes very relevant here. CLT states that human working memory has a very limited capacity. Therefore, effective instructional design must manage cognitive load to prevent overload.²⁹ CLT distinguishes three types of loads: intrinsic loads (the complexity of the material it self), extrinsic

²⁴ "Learn Arabic - Apps on Google Play," accessed September 14, 2025, <https://play.google.com/store/apps/details?id=com.atistudios.italk.ar&hl=id>.

²⁵ Ana Mualimah et al., "Riview Literature: Technological Pedagogical and Content Knowledge (TPACK) in Teaching Arabic Language Skills," *Indonesian Journal of Education* 6, no. 1 (January 2025): 421–29, <https://doi.org/10.59141/japendi.v6i1.7236>.

²⁶ Matthew J Koehler et al., "The Technological Pedagogical Content Knowledge Framework for Teachers and Teacher Educators," Research Gate, accessed September 14, 2025, https://www.researchgate.net/publication/267028784_The_Technological_Pedagogical_Content_Knowledge_Framework_for_Teachers_and_Teacher_Educators.

²⁷ Shuqiong Luo and Di Zou, "A Systematic Review of Research on Technological, Pedagogical, and Content Knowledge (TPACK) for Online Teaching in the Humanities," *Journal of Research on Technology in Education* 56, no. 3 (May 2024): 332–46, <https://doi.org/10.1080/15391523.2022.2139026>.

²⁸ Mualimah et al., "Literature Riview."

²⁹ John Sweller, Jeroen J. G. Van Merriënboer, and Fred G. W. C. Paas, "Cognitive Architecture and Instructional Design," *Educational Psychology Review* 10, no. 3 (September 1998): 251–96, <https://doi.org/10.1023/A:1022193728205>.

loads (unnecessary loads resulting from poor design), and germane loads³⁰ (mental effort dedicated to deep learning).³¹ Well-designed learning applications implicitly apply the principles of CLT. Features such as breaking down complex lessons into small units, providing worked examples, or using clear visual cues serve to minimize extrinsic load. This frees up valuable cognitive resources to be allocated to the German load, which is the process of building a strong knowledge schema in long-term memory.³²

This principle fits closely with Vygotsky's Zone of Proximal Development (ZPD) theory, which defines ZPD as the distance between what learners can do independently and what they can achieve with help.³³ This assistance, known as scaffolding, must be tailored to the learner's ability level challenging enough to encourage development, but not so difficult as to cause frustration.³⁴ Modern technology, particularly AI-powered adaptive learning systems, can serve as the ideal digital More Knowledgeable Other. The system can dynamically assess student performance and automatically provide the right level of scaffolding, keeping each learner within their individual ZPD. Thus, the technology enables the implementation of ZPD and CLT principles at scale, an achievement that is difficult to achieve in traditional classrooms.³⁵

Pedagogical Technology and Innovation in Computer Aided Arabic Learning

The integration of technology in Arabic language learning has given birth to a diverse ecosystem of applications, platforms, and digital media. An analysis of this realm reveals not only the typology of the tools available, but also the underlying pedagogical innovations, especially in terms of artificial intelligence (AI) based gamification and personalization. ICT based learning media in Computer Aided Arabic Learning can be classified based on their function. These classifications include: presentation media such as PowerPoint and Canva that are used for material visualization; virtual meeting platforms such as Zoom and Google Meet that serve as a substitute for physical classrooms; and self-paced learning platforms that allow flexible access to materials.³⁶

³⁰ Germane loads are mental efforts or cognitive resources that learners use to process new information, integrate it with existing knowledge, and build complex mental structures (schemas). This load is a positive aspect of cognitive load theory, as it improves comprehension and memory by facilitating productive learning processes, such as summarizing information, explaining concepts, and connecting new knowledge with old ones. "How Germane Loads Impacts Learning - Readability," accessed September 14, 2025, <https://www.readabilitytutor.com/germane-load/>.

³¹ Slava Kalyuga, "Expertise Reversal Effect and Its Implications for Learner-Tailored Instruction," *Educational Psychology Review* 19, no. 4 (December 2007): 509–39, <https://doi.org/10.1007/s10648-007-9054-3>.

³² "Cognitive Load in Language Processing | Psychology of Language Class Notes," Fiveable, accessed September 14, 2025, <https://fiveable.me/psychology-language/unit-9/cognitive-load-language-processing/study-guide/2mXGkycjLQFxFxKImC>.

³³ Jerome S. Bruner, "The Act of Discovery," *Harvard Educational Review* (US) 31 (1961): 21–32.

³⁴ L. S. Vygotsky, *Mind in Society: Development of Higher Psychological Processes*, ed. Michael Cole et al. (Harvard University Press, 1980), <https://doi.org/10.2307/j.ctvjf9vz4>.

³⁵ Kalyuga, "Expertise Reversal Effect and Its Implications for Learner-Tailored Instruction."

³⁶ Novita and Munawir, "Arabic Language Learning Media Based on Information Communication Technology in Online Learning in Elementary Schools." *Computer Aided Arabic Language Learning: A Systematic Review of Technology Integration and Effectiveness* 9 | Hasyim Asy'ari, et al.

Beyond these general media, the market for specific applications for Arabic language learning offers a broad spectrum, which can be further categorized as follows:

First; Common Language Apps with Arabic Language Support: Global platforms like Duolingo, Memrise, and Drops have incorporated Arabic into their curriculum. The app generally stands out for its user-friendly interface and the use of techniques such as gamification and remote reps for vocabulary mastery. *Second;* Custom Apps and Digital Dictionaries: This category includes apps designed with more specific features. Mondly, for example, uses advanced speech recognition technology for pronunciation feedback. Meanwhile, Mu'jam Al-Ma'aniy serves as a comprehensive digital dictionary that aggregates definitions from various trusted sources. *Third;* Apps for Kids: Apps like Secil and "Arabic Alphabet" are designed specifically for early learners, using animations, sounds, and games to introduce basic vocabulary and Arabic letters in an interactive and engaging way. *Fourth;* Structured Online Course Platforms: Services like Madinah Arabic and Arab Academy offer a more formal model, with structured curriculum, 1-to-1 private classes, and guidance from professional tutors. The platform targets learners who are looking for a more immersive and personalized learning experience.³⁷ To give you a clearer picture, the following table presents a comparative overview of some of the popular apps and platforms.

Table 1: Overview of Computer Aided Arabic Language Learning Applications and Platforms

Application Name/ Platform	Key Features	Skills Supported (Maharah)	Target Users	Advantages & Limitations
Duolingo	Gamifikasi, Pengenalan Suara	<i>Istima', Kalam</i>	Beginner	Fun, interactive; Limitations on complex grammatical explanations.
Mondly	<i>Speech Recognition, Adaptive Learning, Leaderboard</i>	<i>Istima', Kalam, Qiraah, Kitabah</i>	All Levels	Advanced technology, adaptive, conversational focus; Requires a stable internet connection.
Memrise	Native Speaker Videos, Vocabulary Exercises	<i>Istima', Kalam, Kitabah</i>	All Levels	Authentic material from native speakers; Sometimes it can be too challenging for absolute beginners.
Drops	Visual Content, Gamification	Vocabulary	Beginner	Very visually appealing, focus on quick

³⁷ Ningsih Manoppo, Siti Aliyya Laubaha, and Nurhanifa Basarata, "Ragam Aplikasi Dalam Pembelajaran Bahasa Arab," *Assuthur: Jurnal Pendidikan Bahasa Arab* 1, no. 2 (January 2023): 80–97, <https://doi.org/10.58194/as.v1i2.473>.

Application Name/ Platform	Key Features	Skills Supported (<i>Maharah</i>)	Target Users	Advantages & Limitations
Secil	Animation, Sound, Games	Vocabulary, <i>Istima'</i>	Children	vocabulary acquisition; Study time is limited in the free version. Attractive appearance, child-friendly, can be used offline.
Mu'jam Al-Ma'aniy	Comprehensive Digital Dictionary	Vocabulary, <i>Qiraah</i>	All Levels	A very complete multi-source dictionary; Serves as a reference tool, not a training platform.
Madinah Arabic & Arab Academy	Professional Tutor	<i>Istima'</i> , <i>Kalam</i> , <i>Qiraah</i> , <i>Kitabah</i>	All Levels	Highly personalized learning, structured curriculum; Cost-based and requires a time commitment.

Behind the interface of these apps is a pedagogical strategy designed to increase motivation and learning effectiveness. The two most prominent innovations are gamification and AI based adaptive learning. Gamification is the use of game design elements in a non-game context.³⁸ However, its effectiveness can be understood through a spectrum. On the one hand, the superficial implementation applies the principles of Behaviorism directly: points, badges, and streaks serve as extrinsic positive reinforcement to encourage repetition and habit formation.³⁹ While effective as a "hook" for initial engagement, this approach risks reducing intrinsic motivation if learners are motivated only by external rewards.

On the other side of the spectrum, more sophisticated gamification designs are rooted in Self Determination Theory (SDT).⁴⁰ SDT states that intrinsic motivation is driven by the fulfillment of three basic psychological needs: Autonomy, Competence, and Connectedness.⁴¹ Apps like

³⁸ Abdul Ghofur et al., "Students' Perceptions And Motivation towards Teaching Arabic Vocabulary Through Gamification," *Ijaz Arabi Journal of Arabic Learning* 6, no. 3 (October 2023), <https://doi.org/10.18860/ijazarabi.v6i3.18642>.

³⁹ "B. F. Skinner | Department of Psychology," accessed September 14, 2025, <https://psychology.fas.harvard.edu/people/b-f-skinner>.

⁴⁰ Richard M. Ryan and Edward L. Deci, "Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being," *American Psychologist* (US) 55, no. 1 (2000): 68–78, <https://doi.org/10.1037/0003-066X.55.1.68>.

⁴¹ Richard M. Ryan and Edward L. Deci, "Intrinsic and Extrinsic Motivation from a Self-Determination Theory Perspective: Definitions, Theory, Practices, and Future Directions," *Contemporary Educational Psychology* 61 (April 2020): 101860, <https://doi.org/10.1016/j.cedpsych.2020.101860>.

Duolingo, when analyzed through SDT lenses, show intelligent design.⁴² The ability to choose one's own learning path meets the need for Autonomy. The level, XP points, and instant feedback system provides a sense of accomplishment and mastery, which meets the need for Competency. Meanwhile, the leaderboard and online community features foster a sense of healthy competition and togetherness, which meets the need for Connectedness.⁴³ Thus, effective gamification moves beyond simple behavior modification towards the fulfillment of deeper psychological needs, capable of maintaining motivation in the long run.

The frontier of pedagogical innovation in Computer Aided Arabic Learning is Adaptive Learning and Artificial Intelligence. In contrast to the "one for all" model, adaptive systems aim to create a truly personalized learning path.⁴⁴ Using machine learning algorithms, the system can analyze student performance in real time and dynamically adjust the difficulty level of the material, provide reinforcement on weak areas, and recommend the next most relevant activity.⁴⁵

Natural Language Processing technology (NLP) plays a key role in this. Speech recognition features in apps like Mondly, for example, use NLP to provide instantaneous and detailed feedback on students' pronunciation, mimicking the role of a human language tutor. This innovation directly implements the theoretical framework discussed earlier. An adaptive AI system is essentially an automation engine for managing Cognitive Load and providing scaffolding within the Zone of Proximal Development, ensuring that each student receives the optimal level of challenge and support at every stage of their learning journey.⁴⁶

Empirical Analysis, Impacts, and Implementation Challenges

Although the theoretical and technological potential of Computer Aided Arabic Learning is promising, critical evaluation of it must be based on empirical evidence, a balanced impact analysis, and recognition of the real implementation challenges in the field. A number of empirical studies have consistently shown the positive impact of Computer Aided Arabic Learning on student learning outcomes. These studies, which used a variety of methodologies, provide strong quantitative evidence regarding the effectiveness of this approach.

⁴² Lovandri Dwanda Putra, Siti Ro'ihatul Janah, and Siti Robiatun Adawiyah, "Penerapan E-Learning Dengan Aplikasi Duolingo Untuk Meningkatkan Motivasi Belajar Siswa Sekolah Dasar," *Pendas Mahakam : Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar* 9, no. 2 (July 2024): 157–67.

⁴³ Dewi Nazilatul Maghfirah, Taufik Taufik, and Aliwafa Aliwafa, "Menjadikan Pembelajaran Mufradat Menyenangkan: Strategi Inovatif Untuk Meningkatkan Motivasi Belajar Bahasa Arab Di MI," *Al-Madrasah: Jurnal Ilmiah Pendidikan Madrasah Ibtidaiyah* 8, no. 4 (October 2024): 1842–53, <https://doi.org/10.35931/am.v8i4.4081>.

⁴⁴ Azwir Azwir et al., "Using Artificial Intelligence in Arabic Learning: Opportunities and Challenges: استخدام الذكاء الاصطناعي في تعلم اللغة العربية: الفرص والتحديات," *EL-MAQALAH: Journal of Arabic Language Teaching and Linguistics* 5, no. 2 (December 2024): 1–15, <https://doi.org/10.22373/maqalah.v5i2.6219>.

⁴⁵ Cut Keumalawati and Ahmed Hossam, "Adaptive Learning Technologies in Arabic Language Education: Designing for Flexibility and Accessibility," *International Journal of Language and Ubiquitous Learning* 2, no. 4 (December 2024): 529–37, <https://doi.org/10.70177/ijlul.v2i4.1807>.

⁴⁶ Kalyuga, "Expertise Reversal Effect and Its Implications for Learner-Tailored Instruction."

A significant experimental study conducted at SMAN 1 Labakkang compared a group of students using computer-aided learning media with a control group using traditional methods. The results showed that the experimental class experienced a statistically "more significant" increase in Arabic language proficiency, indicating that technological interventions had a real and positive influence.⁴⁷ Another study focusing on the development of multimedia products for Muhammadiyah high school/vocational high school students also came to a similar conclusion. Through t-test analysis of pre-test and post-test scores, the study found a statistically significant increase in student achievement, with a t-value of 12.84, which far exceeded the critical score of 2.02. This expressly validates the multimedia product as an effective learning medium.⁴⁸

In the realm of Mobile-Assisted Language Learning (MALL), the evidence of effectiveness is also getting stronger. An empirical study examining the use of mobile apps for Arabic vocabulary acquisition found that the app significantly improved vocabulary retention and learner engagement compared to conventional methods.⁴⁹ A broader meta-analysis of language learning applications found a moderate to strong overall effect ($g=0.88$) on learning achievement compared to the control group.⁵⁰ These findings are summarized in the following table.

Table 2: Synthesis of Empirical Study Results on the Effectiveness of Computer-Aided Arabic Learning

Name of Research / Reference	Location/Subject	Research Methods	Key Findings
Influence of CALL Media	SMAN 1 Labakkang	Experiments (control classes & experiments)	Students' Arabic proficiency in the experimental classroom increased more significantly.
Multimedia Development	SMA/SMK Muhammadiyah	Product development & t-testing	There was a statistically significant improvement in student achievement

⁴⁷ Anhar Batara Syawal, "Pengaruh Penggunaan Media Computer Assisted Language Learning (Call) Bahasa Arab Siswa Sman 1 Labakkang Kabupaten Pangkep," *Jurnal Sarjana Ilmu Budaya* 2, no. 2 (Mei) (November 2022), <https://journal.unhas.ac.id/index.php/jsbsk/article/view/19486>.

⁴⁸ Isnaningsih, "Pengembangan Multimedia Pembelajaran Bahasa Arab Berbantuan Komputer Di SMA/SMK Muhammadiyah."

⁴⁹ Muhamad Khairul Anuar Zulkepli, Mohd Zulkhairi Abd Hamid, and Basma Ahmad Sidqi Dajani, "The Impact of Mobile Applications on Arabic Language Acquisition: A Pedagogical Perspective," *International Journal of Research and Innovation in Social Science* VIII, no. VIII (2024): 4443–51, <https://doi.org/10.47772/IJRIS.2024.8080340>.

⁵⁰ Muneera Bano et al., "Mobile Learning for Science and Mathematics School Education: A Systematic Review of Empirical Evidence," *Computers & Education* 121 (June 2022): 30–58, <https://doi.org/10.1016/j.compedu.2022.02.006>.

Name of Research / Reference	Location/Subject	Research Methods	Key Findings
			(t=12.84) after using the product.
Impact of Mobile Apps	Native Arabic-speaking students	Mixed method	Vocabulary retention and learner engagement are significantly improved with mobile apps.
MALL analysis	Meta-Learners of multiple languages	Meta-analysis	Moderate to strong overall effect (g=0.88) on learning achievement using mobile apps.

The implementation of Computer Aided Arabic Learning has a wide impact, both positive and negative. The most commonly reported positive impact is increased motivation and interest in learning. The interactive, visual, and often gamified nature of the material makes students more excited and comfortable in learning. In addition, technology promotes independence and autonomy in learning, allowing students to access materials anytime and anywhere, reducing reliance on teachers as the sole source of knowledge. Finally, Computer Aided Arabic Learning enriches students' insights through multimedia content that integrates text, sound, and video, presenting information in a richer and more absorbable way than static textbooks.

However, behind these benefits, there are potential negative impacts that need to be watched out. Learning that is too technology-oriented can give rise to the "Autonomy Paradox". On the one hand, technology encourages independence, which is a positive pedagogical goal. On the other hand, extreme autonomy without adequate guidance and social interaction can lead to individualistic attitudes and social isolation. There is also the risk of technology addiction and decreased creativity, where students become too reliant on the instant solutions offered by digital tools rather than developing their own problem-solving abilities. This underlines that the role of teachers is not replaced, but rather transformed into facilitators who must actively manage the balance between technology-based self-paced learning and healthy social interaction.

The potential of Computer Aided Arabic Learning is often hampered by a series of substantial and interrelated implementation challenges. Infrastructure and Access Challenges or Digital Divide, This is the most fundamental barrier, especially in developing countries like Indonesia. The

availability of adequate devices, stable and even internet access, and affordable quota costs are still a problem in many regions, hindering the optimal implementation of Computer Aided Arabic Learning. Educator Competency Challenge or TPACK Gap, Many Arabic teachers do not have adequate skills to utilize technology effectively. The challenge is not only in technical mastery, but in the ability to integrate it pedagogically with content (TPACK). Without adequate training, technology risks being used only as a substitute for digital whiteboards, without changing the essence of teaching.

Digital Evaluation Challenges or Assessment Gap, There is a critical gap between technological advances in the delivery of materials and their stagnation in authentic assessment. Studies show that Computer Based Test (CBT) is indeed efficient, but "less effective because some Arabic language skills cannot be adequately tested", especially productive skills such as speaking (*kalām*) and creative writing (*kitābah*). The speech recognition feature may be useful for practice, but the results are not yet considered valid for formal assessment. This assessment gap creates a risk where institutions may adopt technology for efficiency without a credible way to measure actual learning outcomes.

Arabic Language Linguistics Challenges, Arabic has inherent complexity, including complex grammar, rich morphology, and wide dialect diversity. Many language learning apps that are generic are not designed to adequately handle these nuances. The development of truly effective AI and NLP tools for Arabic is hampered by the lack of a large, standardized digital data corpus, especially for dialects. This demands closer collaboration between Arabic linguists and technology developers to create more linguistically sophisticated solutions.

CONCLUSION

This systematic literature review has comprehensively mapped the realm of Computer Aided Arabic Language Learning. This study concludes that educational technology holds significant transformative potential in Arabic language learning, shifting the paradigm from teacher-centered methods to more communicative, learner centered approaches. The findings indicate that digital applications such as LMS platforms, gamification tools, and AI based simulators effectively enhance student motivation and vocabulary acquisition.

However, their effectiveness in productive skills like speaking and writing still requires more structured pedagogical design, empowering teachers through comprehensive training in how to blend technology with pedagogy (TPACK) and creating balanced blended learning models are essential next steps. Future research should also focus on longitudinal studies, exploration of

learning contexts in remote areas, and the development of specialized AI tools for Arabic productive skills.

The limitations of this review include possible publication bias and the incomplete coverage of Arabic-language research. Therefore, further studies with broader database coverage and more comprehensive meta-analytical approaches are needed. Overall, the future of Arabic language learning lies in developing an integrated digital ecosystem that combines technological sophistication with strong pedagogical principles. Collaboration among educators, researchers, and technology developers will determine the realization of Arabic language learning that is adaptive, inclusive, and relevant to the demands of the digital era.

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