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The Use of CALL in Teaching Arabic as a Foreign Language in South Africa: Towards an Inclusive and Digital Divide Approach

Dr. Tawffeek A. S. Mohammed *

tmohammed@uwc.ac.za

Abstract

This conceptual study explores the potential application of Computer-Assisted Language Learning (CALL) tools in teaching Arabic as a foreign language (AFL) in South Africa, with a particular emphasis on inclusion and bridging the digital divide. Drawing on the author's ongoing work on a forthcoming book, this paper surveys a range of technological tools, from traditional desktop-based applications to more recent innovations including Web 2.0 platforms, gamification environments, and emerging artificial intelligence (AI) tools. The study argues that while technological advancements in language education offer exciting possibilities, especially for enhancing engagement and self-directed learning, it is essential to adopt a balanced approach that accounts for the socio-economic and infrastructural realities of underprivileged communities in South Africa. Rather than advocating for the wholesale replacement of traditional tools, the study promotes a hybrid model that integrates both established and emerging technologies in a pedagogically sound and context-sensitive manner. By mapping the landscape of available tools and considering their potential for inclusivity and accessibility, this study contributes to ongoing discussions around equitable digital transformation in language education. It also sets the stage for future empirical research that could assess how these tools are adopted and adapted in real classroom settings.

Keywords: Arabic, CALL, Digital Inclusion, Gamification, Hybrid Learning.

* Associate Professor of Applied Linguistics and Translation Studies, Department of Foreign Languages, University of the Western Cape, South Africa.

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استخدام تقنيات تعلّم اللغة بمساعدة الحاسوب في تعليم العربية بوصفها لغةً أجنبية في جنوب أفريقيا: نحو مقاربة شاملة لردم الفجوة الرقمية

د. توفيق ع. س. محمد*
tmohammed@uwc.ac.za

الملخص:

تستكشف هذه الدراسة المفهومية إمكانات توظيف أدوات تعلم اللغة بمساعدة الحاسوب (CALL) في تعليم اللغة العربية للناطقين بغيرها في جنوب أفريقيا. وتركز الدراسة بشكل خاص على قضايا الشمولية وردم الهوّة الرقمية، ويستعرض البحث طيفًا واسعًا من الأدوات التكنولوجية، بدءًا من التطبيقات التقليدية المعتمِدة على الحواسيب المكتبية ووصولًا إلى الابتكارات الحديثة، بما في ذلك منصّات الويب 2.0، وبيئات التلعيب، والأدوات الناشئة في مجال الذكاء الاصطناعي. وترى الدراسة بأنّ التطوّر التقني في ميدان تعليم اللغات يقدّم آفاقًا واعدة، لا سيما في تعزيز التفاعل والتعلّم الذاتي، غير أنّه من الضروري اعتماد مقاربة متوازنة تراعي الأوضاع الاجتماعية-الاقتصادية والبُنى التحتية الهشّة لدى المجتمعات الفقيرة والمحرومة في جنوب أفريقيا. وبدلًا من الدعوة إلى الاستبدال الشامل للأدوات التقليدية، يقترح البحث نموذجًا هجينًا يدمج بين الطرق التقليدية والابتكارات المستجدّة في إطار تربوي رصين يراعي السياق المحلي. ومن خلال رسم خريطة لمشهد الأدوات المتاحة والنظر في إمكاناتها من حيث الشمولية وإتاحة الوصول، تُسهم هذه الورقة في النقاشات الجارية حول التحوّل الرقمي العادل في تعليم اللغات، كما تمهّد لبحوثٍ تجريبية مستقبلية حول كيفية توظيف هذه الأدوات وتكييفها في بيئات صفّية واقعية.

الكلمات المفتاحية: تعليم اللغة العربية، التعلّم بمساعدة الحاسوب (CALL)، الشمول الرقمي، التلعيب، التعلم المدمج أو الهجين.

* أستاذ اللغويات التطبيقية ودراسات الترجمة، قسم اللغات الأجنبية، جامعة ويسترن كيب، جنوب أفريقيا.

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1 Introduction

In an era characterised by rapid technological progress, the integration of digital tools into education has become both unavoidable and vital. Building on this broader digital transformation in education, computer-assisted language learning (CALL) marks a significant development in the field of language education, offering innovative ways to enhance learner engagement, interactivity, and independence (Chapelle, 2001; Garrett, 2009). As digital technologies become more deeply embedded in educational practices worldwide, they open new opportunities for language learners to access resources, practise skills, and engage with authentic language use beyond the classroom (Shadiev & Wang, 2022).

Globally, the rapid expansion of digital technologies in education has raised significant concerns about equity, access, and the uneven distribution of digital resources. Despite the promise of digital learning, many countries continue to grapple with disparities in internet connectivity, technological infrastructure, and digital literacy, which affect learners' ability to benefit from educational technologies (Warschauer, 2004; UNESCO, 2023). Building on these global concerns, South Africa faces similar, yet more pronounced challenges due to its socio-economic inequality and the coexistence of well-resourced urban schools alongside severely under-resourced township and rural institutions. The digital divide, defined as the gap between individuals who have access to modern information and communication technology (ICT) and those who do not, continues to influence educational opportunities across the country (Czerniewicz & Brown, 2014).

Arabic, as a foreign language, occupies a unique yet largely understudied position within South Africa's multilingual education landscape. Although interest in Arabic has increased due to religious, cultural, and geopolitical factors, research on how Arabic is taught, especially through technology, remains limited. Existing studies highlight gaps in infrastructure, curriculum design, and teacher digital preparedness, all of which hinder the development of effective Arabic instruction in both formal and informal learning environments (Mohammed et al., 2021). This lack of systematic research on technology-supported Arabic learning in South Africa represents a significant gap that requires scholarly attention. Addressing this gap is essential because unequal access to digital tools and limited Arabic-specific CALL resources risk widening existing educational inequalities. Therefore, identifying context-appropriate and inclusive technological solutions becomes crucial for supporting equitable Arabic language learning across diverse South African communities.

This paper responds to the identified gap by examining how CALL can be meaningfully integrated into Arabic language education in South Africa, with a particular focus on inclusivity and reducing the digital divide. Positioned as a conceptual study, it synthesises existing literature, theoretical frameworks, and

technological developments to propose a context-sensitive model for integrating technology into Arabic instruction. Drawing on a broad range of technological tools from traditional desktop software to emerging innovations such as Web 2.0 platforms, gamification, and artificial intelligence, the study proposes a context-aware hybrid approach. Instead of advocating for a complete shift to digital-only methods, it promotes integrating technology in ways that enhance pedagogy whilst recognising infrastructural constraints (Warschauer & Healey, 1998).

CALL tools relevant to Arabic language learning can take various forms. In light of the gaps and challenges facing Arabic language instruction in South Africa, CALL tools offer practical opportunities to address issues such as uneven infrastructure, limited resources, and varied learner proficiency. They encompass a wide range of technologies, from traditional desktop software such as Hot Potatoes and other desktop authoring tools to more modern digital platforms. Web 2.0 environments, including wikis, blogs, and video-sharing sites, are widely used for their collaborative and learner-generated content features. These tools also include gamified learning systems that incorporate game mechanics to boost engagement and motivation. Additionally, emerging AI-driven tools, like chatbots and intelligent tutoring systems, are included due to their growing importance in delivering adaptive, interactive, and personalised learning experiences. Collectively, these tools not only illustrate the diverse technological landscape supporting Arabic language learning but also demonstrate how technology can respond directly to the pedagogical and contextual challenges outlined earlier, especially the need for inclusive, accessible, and flexible learning approaches.

By mapping current CALL tools and evaluating their potential for equitable implementation, this paper contributes to broader discussions about digital transformation in education. It also lays the groundwork for future empirical research on how these tools are adopted and adapted in real-world classroom settings within under-resourced contexts. The objectives of this study are

1. To explore the potential of CALL tools for teaching Arabic in South Africa.
2. To highlight the importance of inclusivity and closing the digital divide in language education.
3. To propose a hybrid approach that blends traditional and digital methods.
4. To assess the suitability and accessibility of various technological tools in disadvantaged contexts.
5. To inform future empirical research on CALL implementation in classrooms.

To fulfil these objectives, the study attempts to answer the following questions:

1. How can CALL tools be adapted to meet the needs of under-resourced Arabic language learners in South Africa?
2. What are the challenges and opportunities in implementing a hybrid model of language teaching in disadvantaged communities?

3. To what extent do Web 2.0 tools enhance learners' engagement and learning outcomes in Arabic language classrooms?

2 Literature Review

1. CALL in Language Education

CALL refers to the use of computers and digital technologies to support, enhance, and deliver language instruction. It encompasses both software-based and internet-based tools designed to facilitate language learning through interaction, feedback, and learner autonomy (Chapelle, 2001). CALL has evolved significantly since its inception, moving from behaviourist drill-and-practice programmes to more communicative, interactive, and learner-centred approaches (Warschauer & Healey, 1998). Contemporary CALL integrates multimedia, internet-based tools, and increasingly, artificial intelligence, to enhance language acquisition. However, it should be emphasized that CALL's effectiveness depends on its pedagogical alignment and its ability to promote meaningful interaction, feedback, and learner independence (Bahari et al., 2025). As CALL expanded, its scope broadened beyond traditional desktop software to include online and collaborative technologies. The recent integration of Web 2.0 platforms (blogs, wikis, forums) has further expanded opportunities for collaborative and authentic language use (Levy & Stockwell, 2013). These Web 2.0 tools are considered part of CALL because they employ digital technologies to support language learning, promote interaction, enable learner-generated content, and facilitate communication (Mohammed et al., 2020). These core principles are aligned with modern CALL frameworks. Together, these developments show how CALL has shifted from simple computer drills to rich, interactive, socially mediated learning environments. This evolution marks an ongoing transformation in language pedagogy, highlighting the need for educators to integrate CALL tools strategically and purposefully.

2. Arabic Language Learning and CALL

Research into the use of CALL for teaching Arabic is still evolving but growing. Due to the complexity of Arabic's script, diglossia, and phonetic variation, technological tools offer clear advantages, especially in areas such as pronunciation, script recognition, and vocabulary learning (Al Seghayer, 2001). Several global studies have demonstrated the effectiveness of CALL in Arabic language acquisition. For example, Al-Jarf (2007) found that CALL-based vocabulary programmes significantly improved retention and learner motivation among university-level Arabic learners. Likewise, Oma et al. (2021) reported that computer-based instruction enhanced learners' reading comprehension and engagement. Research by AbuSeileek (2012) showed that CALL-supported collaborative writing activities improved grammatical accuracy and communicative competence, while the use of speech-recognition tools has been shown to assist learners in mastering Arabic phonology and pronunciation (Elimat & AbuSeileek, 2014). These studies suggest that CALL

has strong potential to support skill development across reading, writing, listening, speaking, and vocabulary in diverse Arabic learning contexts. However, most existing CALL platforms have been developed primarily for Indo-European languages, resulting in limitations in content adaptability and linguistic nuance for Arabic learners (Sarah et al., 2024). The shortage of high-quality, Arabic-specific CALL resources remains an issue, particularly in non-Arabic-speaking regions like South Africa.

3. Technology-enhanced Arabic language learning in South Africa

The review in this section synthesises findings from six studies on technology-enhanced learning (TEL) and blended learning in teaching Arabic as a foreign language (AFL) in South Africa. Although these studies do not always explicitly label their interventions as CALL, they all involve integrating digital tools, platforms, or computer-mediated learning environments, thereby placing them within the broader CALL framework. CALL research often includes technology-enhanced learning (TEL), blended learning, and online learning practices because they employ digital systems to deliver, scaffold, or assess language instruction. Therefore, reviewing these South African studies is directly relevant to understanding how CALL principles are already emerging in local Arabic programmes.

Conducted mainly at two higher education institutions, namely the International Peace College South Africa (IPSA) and the University of the Western Cape (UWC), these studies provide converging evidence that digital and blended approaches can enhance learning outcomes, motivation, and pedagogical alignment when based on coherent instructional design frameworks.

Across the reviewed studies, technology-enhanced learning (TEL) and blended learning consistently produced positive linguistic outcomes. The strongest evidence comes from a 12-week randomized controlled trial at IPSA (Mohammed et al., 2020), which showed statistically significant gains in overall language skills and vocabulary for students using Web 2.0 tools compared to a traditional class. Two additional blended-learning designs, one based on ADDIE (Mohammed, et al., 2021) and another aligned with South Africa's National Qualifications Framework (NQF) in an Arabic for Specific Purposes course (Mohammed et al., 2021), also reported improved proficiency and development of transferable skills such as communication, critical thinking, and teamwork.

These studies show that although CALL-focused Arabic research in South Africa is limited, existing work already reflects CALL principles such as multimodality, interaction, learner autonomy, and digital scaffolding. By analysing these studies, this review highlights how local institutions have started integrating CALL elements, even if the research does not always use CALL-specific terminology.

Learners generally expressed positive attitudes toward technology-mediated Arabic learning. A full online listening–speaking course delivered through NEO LMS during COVID-19 showed statistically

significant positive perceptions of flexibility, multimedia materials, and interactive tasks (Mohammed, 2022a). The ADDIE-based blended program also produced high satisfaction, with female learners reporting slightly more positive attitudes (Mohammed et al., 2021). A case study at UWC emphasized that well-structured digital integration, guided by Technological Pedagogical Content Knowledge (TPACK) and Bloom's taxonomy, helped sustain engagement and continuity during the pandemic (Mohammed, 2022).

All studies highlight that the effectiveness of technology depends on purposeful design, not on tools alone. Successful programs used structured models such as ADDIE, TPACK, SAMR, and Bloom's taxonomy to align content, pedagogy, and technology.

Within the reviewed studies, several core digital tools were consistently utilized to support Arabic language learning. Learning Management System (LMS) platforms such as NEO and Moodle served as the primary organizational frameworks, facilitating the delivery and management of course content. To ensure seamless integration of resources and activities, interoperability standards like Learning Tools Interoperability (LTI) and Shareable Content Object Reference Model (SCORM) were implemented. These standards enabled the incorporation of diverse learning modules and assessments into the LMS.

Additionally, a range of Web 2.0 applications, including blogs, podcasts, and interactive tools such as H5P, were employed to enrich the learning experience. These tools promoted learner engagement, collaboration, and authentic language use by enabling students to create and interact with multimedia content.

In the context of the Arabic for Specific Purposes (ASP) blended model, every digital activity was purposefully mapped to outcomes outlined in South Africa's National Qualifications Framework (NQF). This alignment ensured that instruction followed a replicable, competency-based approach, directly linking digital learning activities to measurable language competencies and transferable skills.

Despite promising results, the evidence base remains methodologically limited: small samples, single-site studies, and heavy reliance on self-report data. Infrastructure barriers such as inconsistent LMS usage and unstable internet connectivity also limit scalability.

Overall, these studies show significant progress in CALL-driven Arabic teaching in South Africa. However, the limited research highlights a notable gap in the literature, which is not a flaw in the current study's design. Highlighting these six studies emphasises the shortage of research and points to the urgent need for more comprehensive, large-scale studies on CALL for Arabic in the South African context.

Consequently, the findings of these studies reveal both progress and gaps: South African institutions are experimenting with CALL-related practices for Arabic, yet the field remains underdeveloped and fragmented. There is a clear need for future multi-site experimental research, teacher training in CALL

pedagogy, and institutional strategies to support sustainable, inclusive integration of CALL in Arabic language education.

*4. **Digital Divide and Access in South Africa***

The success of CALL implementation is deeply affected by the digital divide in terms of infrastructure and digital literacy. South Africa highlights a clear divide between urban areas with high connectivity and rural or township regions where internet access, reliable electricity, and hardware are scarce (Czerniewicz & Brown, 2014). Digital inequalities also overlap with broader socio-economic disparities, impacting learners' access to devices, data, and support systems (Tustin et al., 2012). Therefore, any meaningful integration of CALL must take into account local realities and develop flexible, inclusive solutions.

*5. **Inclusion, Hybrid Models, and Contextual Pedagogy***

To bridge these gaps, scholars are increasingly endorsing hybrid or blended learning models that combine traditional face-to-face teaching with accessible digital tools (Hermita et al., 2024; Niyomves et al., 2024; Singh et al., 2021). These models are particularly relevant in under-resourced environments, where full-scale digital implementation might be impractical. The hybrid approach also aligns with inclusive pedagogical principles by accommodating diverse learner needs, promoting differentiated instruction, and enabling community-centred adaptations (Li et al., 2025).

*6. **Gamification and AI in Language Learning***

Emerging tools like gamification and artificial intelligence are transforming the CALL landscape. Gamified environments have been proven to boost motivation and engagement through interactive tasks, rewards, and game-like challenges (Roseni & Muho, 2024). AI-driven applications, such as chatbots and adaptive learning platforms, provide personalised feedback and language modelling, enabling learners to progress at their own pace (Feroce et al., 2025; Kim, 2022). While these technologies show promise, careful implementation is crucial to ensure they are accessible, culturally relevant, and aligned with pedagogical goals.

3 Theoretical and Conceptual Framework

Although frameworks such as Sociocultural Theory, TPACK, and the Digital Equity Framework are often used in empirical studies, they are equally important in conceptual and review-based research because they offer analytical perspectives for interpreting existing literature, assessing technological tools, and spotting gaps in current practice. In a conceptual study like this one, these frameworks do not direct data collection; instead, they organise the review, influence the criteria used to evaluate CALL tools, and aid in developing a context-sensitive model for Arabic language instruction in South Africa.

Therefore, this study is guided by a multidisciplinary theoretical framework drawing on Sociocultural Theory, Technological Pedagogical Content Knowledge (TPACK), and the Digital Equity Framework. These perspectives together provide a lens for understanding how technology can be thoughtfully integrated into Arabic language instruction in South Africa in ways that are pedagogically sound, socially inclusive, and suitable for the context.

1. ***Vygotsky's Sociocultural Theory***

Sociocultural theory emphasises the significance of social interaction and cultural context in cognitive development and language learning (Vygotsky, 1978). In CALL, this perspective highlights the importance of meaningful interaction, scaffolding, and collaborative learning environments.

From a CALL perspective, Sociocultural Theory sees digital tools not just as delivery mechanisms but as mediational means that provide opportunities for learners to participate in authentic, socially situated language use. Tools such as discussion forums, peer feedback platforms, WhatsApp groups, and shared writing spaces function as "mediating artefacts" that allow learners to construct knowledge through interaction, negotiation of meaning, and guided participation. This aligns with the Zone of Proximal Development (ZPD), where learners progress through suitable digital scaffolds, teacher support, and peer collaboration.

Regarding Arabic language teaching, it underlines the need for tools that support dialogic engagement, authentic communication, and community-based learning, especially relevant in multilingual and multicultural South African classrooms (Lantolf et al., 2014). CALL platforms featuring peer interaction, discussion forums, and cultural content are well aligned with this approach.

Furthermore, in the South African context, where learners often study Arabic within religious, community, or multilingual settings, Sociocultural Theory offers a strong rationale for integrating CALL tools that leverage learners' social networks and cultural backgrounds. The theory advocates a view of CALL that is inclusive, rooted in community, and responsive to local linguistic practices. These elements are vital for reducing inequalities and enhancing engagement in under-resourced environments.

2. ***Technological Pedagogical Content Knowledge (TPACK)***

The TPACK framework, developed by Mishra and Koehler (Koehler et al., 2012; Koehler & Mishra, 2009), provides a model for integrating technology into teaching that balances technological, pedagogical, and content knowledge. This framework is particularly useful in evaluating the appropriateness of different CALL tools for Arabic language instruction. It helps educators determine not only whether a tool is technologically sophisticated but also whether it genuinely enhances language pedagogy and aligns with the

specific content needs of Arabic, including its grammar, script, and diglossia. In resource-constrained contexts, TPACK also supports selecting tools that are both pedagogically effective and practically feasible.

*3. **Digital Equity Framework***

Given the socio-economic disparities in South Africa, the Digital Equity Framework offers a vital perspective for assessing the accessibility and inclusivity of CALL tools. Digital equity goes beyond merely access to devices and the internet; it also includes equitable access to high-quality digital content, digital literacy training, and culturally relevant pedagogy (Gorski, 2009; Warschauer, 2004). Using this framework helps ensure that any proposed hybrid model does not exacerbate existing inequalities but instead aims to reduce them by promoting adaptive, low-bandwidth, and mobile-friendly solutions where necessary.

These three theoretical strands underpin a holistic approach to CALL implementation that recognises learners as socially embedded individuals, values context-sensitive pedagogy, and actively addresses systemic barriers to digital inclusion. They form the conceptual foundation of this study's advocacy for a hybrid, inclusive model of Arabic language education in South Africa.

4 Methodology

This study employs a conceptual and exploratory research design to critically assess the role of CALL in teaching Arabic as a foreign language in South Africa. In essence, the design is a qualitative research synthesis (QRS), which involves the systematic, interpretive integration of findings from multiple qualitative and mixed-methods studies to develop new conceptual understanding (Sandelowski & Barroso, 2007; Barnett-Page & Thomas, 2009). Unlike empirical studies, QRS does not gather primary data; instead, it consolidates existing literature to generate theoretical, pedagogical, and contextual insights. This approach is suitable for the present study, given the limited empirical research on Arabic CALL in South Africa and the necessity to synthesise diverse forms of evidence into a coherent conceptual framework.

Instead of collecting primary data, the study critically evaluates existing literature, CALL tools, and pedagogical models relevant to Arabic language learning. The QRS approach enables the study to explore relationships between technology, pedagogy, and digital inclusion in under-resourced environments.

The research process involved four stages typical of qualitative research synthesis: (1) defining the review's scope, (2) systematically collecting relevant literature, (3) extracting and synthesising key concepts, and (4) developing an interpretive framework. The review included peer-reviewed journal articles, conceptual papers, empirical studies, and reports on technology evaluation.

The analysis was conducted using thematic synthesis (Thomas & Harden, 2008), concentrating on key themes from the literature: accessibility, inclusivity, learner autonomy, and contextual adaptability.

The selection of these themes was guided by both theoretical considerations and practical relevance. These themes arose inductively from the reviewed literature and correspond with the core elements of the Digital Equity Framework (access and fairness), Sociocultural Theory (interaction and mediated learning), and TPACK (alignment between pedagogy, content, and technology). They also mirror recurring challenges in Arabic CALL implementation, such as infrastructure constraints, multilingual contexts, and diverse levels of digital literacy. Each category of CALL tools was assessed for its alignment with these themes and its practicality in low-income educational settings. Critical Interpretive Synthesis (Dixon-Woods et al., 2005) was employed to integrate theoretical frameworks with findings from global and African studies. This approach facilitated the development of a conceptual model suited to South Africa's sociolinguistic and economic environment. The synthesis does not seek to generalise statistically but aims to forge an analytically rich understanding that can inform future classroom-based empirical research.

Although the study offers a theoretically grounded framework for integrating CALL in Arabic education, it does not evaluate classroom implementation or learner outcomes. However, by clearly outlining the search strategy, inclusion criteria, and synthesis procedures, the methodology is replicable and can be reused by other researchers in different contexts or for other less commonly taught languages. The main limitation remains the scarcity of South African studies, which further emphasises the need for systematic empirical research in this area.

5 Findings and Discussions

To promote transparency and enhance the quality of the research synthesis, the studies forming the evidence base of this review are summarised in Table 1. The core of the synthesis draws from the six peer-reviewed South African studies that specifically examine CALL or technology-supported Arabic language learning. Because this field is still emerging, these six studies represent the entire body of available local research. To provide context and deepen the thematic interpretation, a small number of highly relevant international studies were also included, especially those focusing on Arabic CALL, digital equity, and language learning in under-resourced multilingual settings. This combined collection of studies offers a sufficiently coherent foundation for identifying recurring themes and addressing the three research questions guiding this study.

Table 1. A Summary of the reviewed studies

Author(s), Year	Context / Country	Language Focus	CALL / TEL Tools Used	Key Findings	Relevance to Current Study
Mohammed et al. (2020)	IPSA, South Africa	Arabic AFL	Web 2.0 (blogs, forums), LMS	RCT showed significant gains in	Demonstrates strong evidence for CALL

				vocabulary and overall proficiency; high engagement	effectiveness in Arabic programmes in SA
Mohammed, Saidi et al. (2021)	IPSA, South Africa	Arabic AFL	Blended learning, ADDIE-based digital modules	Improved proficiency; female students more positive; high satisfaction	Shows importance of instructional design for Arabic CALL
Mohammed, Al-Sowaidi et al. (2021)	IPSA, South Africa	Arabic for Specific Purposes	LMS, LTI, SCORM, Web 2.0	Learning aligned with NQF outcomes; improved communication and teamwork	Exemplifies contextualised, competency-based CALL design
Mohammed (2022a)	IPSA, South Africa	Arabic AFL	NEO LMS during COVID-19	Students reported high motivation, flexibility, and ease of use	Highlights the value of online CALL during educational disruptions
Mohammed (2022b)	UWC, South Africa	Arabic AFL	TPACK-guided blended learning	Digital integration improved continuity and engagement	Confirms the importance of pedagogical–technological alignment
Davids (2019)	South Africa	Arabic in madrasah settings	Limited tech; informal mobile use	Identifies cultural and structural barriers to Arabic learning	Provides context for digital divide issues in Arabic education
Al-Seghayer (2001)	Global	Arabic L2	Multimedia CALL for script & pronunciation	CALL improves recognition of Arabic script and phonology	Provides foundational evidence for Arabic-specific CALL needs
Abdullahi et al. (2018)	Global	Arabic	Online authentic media	Authentic resources increase engagement and comprehension	Supports the use of Web 2.0 for Arabic exposure
Bingimlas (2017)	Global (general CALL)	Various	Blogs, forums, social tools	Web 2.0 increases interaction and motivation	Justifies the inclusion of Web 2.0 in Arabic CALL design
Reinhardt & Thorne (2011)	Global	L2 learning	Social media, online communities	Social participation improves language development	Supports sociocultural CALL approaches

Taylor & Kochem (2022)	Global	Minority languages	CALL tools; accessibility	Highlights the digital divide's role in limiting CALL equity	Strengthens the argument for the Digital Equity Framework
Fitria et al. (2024)	Indonesia	Arabic	AI-based personalised learning	AI supports differentiation; equity concerns remain	Offers comparative insight for AI in Arabic CALL
Fitrianto et al. (2024)	Indonesia	Arabic	AI-driven tools	Potential for bridging the digital divide with AI	Relevant for future CALL recommendations

The studies summarised in Table 1 establish the empirical and conceptual basis for the subsequent findings and discussion. Although the number of South African studies specifically about CALL for Arabic remains limited, the recurring patterns across these six studies, complemented by insights from a small number of directly relevant international works, offer enough depth to generate the themes explored in the next section. The following subsections address each of the study's research questions by synthesising these patterns to determine how CALL can be adapted for under-resourced South African contexts, the challenges and opportunities of hybrid models, and the extent to which Web 2.0 tools enhance engagement in Arabic language learning. This section highlights the key themes emerging from the qualitative research synthesis, each contributing to an understanding of how CALL can be implemented in an inclusive, context-sensitive manner for Arabic language learning in South Africa.

5.1 Adapting CALL for Under-Resourced Arabic Language Learners

This theme examines the adaptations required to ensure CALL tools are accessible and effective for Arabic learners in under-resourced South African contexts. Adapting CALL tools to meet the needs of under-resourced Arabic language learners in South Africa requires a context-aware, equity-focused approach that balances technological potential with socio-economic realities. The adaptation process should consider four key factors: accessibility, cultural relevance, pedagogical alignment, and infrastructure limitations.

Considering the widespread use of mobile phones in South Africa, even in under-resourced areas, CALL tools should be designed for mobile access with offline capabilities (Heeks, 2010). Tools that work on basic smartphones and require minimal data (such as lightweight apps, SMS-based language activities, or downloadable lessons) are essential. For example, Arabic vocabulary apps that store content offline or browser-based tools with offline caching can help address connectivity issues.

To enhance usability, CALL interfaces should be simplified and accessible in learners' first languages (e.g., isiZulu, Afrikaans, or English) where possible (Heugh, 2002). According to the Digital Equity Framework (Warschauer, 2004; Warschauer et al., 2004), linguistic accessibility is as important as technical access.

Learners are more likely to engage with a tool that connects their existing linguistic knowledge with the target language (Arabic), especially at beginner levels.

In this context, pedagogical alignment using the TPACK Framework appears crucial. According to the TPACK model, CALL tools should be customised for Arabic language content, such as script practice, Quranic vocabulary, and Modern Standard Arabic grammar, and aligned with appropriate pedagogical strategies for multilingual and multilevel learners (Ramdhanianty & Zolkafil, 2024). Learning scaffolds, like gradually increasing difficulty and guided pronunciation feedback, along with tools that support collaborative or teacher-assisted activities, help sustain student engagement and improve learning outcomes.

The inclusion of sociocultural elements is equally important. According to Vygotsky's Sociocultural Theory, tools should support social interaction, whether synchronously (e.g., chat features, group learning tasks) or asynchronously (e.g., voice notes, forums). This promotes meaningful language use and community learning, even in situations where formal teaching might be limited. For instance, WhatsApp groups moderated by teachers or community volunteers can be used to extend CALL beyond isolated, individual use (Jeong et al., 2022; Motteram et al., 2020).

Similarly, integrating technology with existing community and religious structures is important. Many learners studying Arabic in South Africa do so for religious reasons and are already involved in madrasahs or mosque-based education (Davids, 2019). CALL tools can be adapted to support traditional teaching by aligning content with religious curricula (e.g., Tajweed, Quranic vocabulary), thus increasing engagement and perceived relevance (Jaafar et al., 2022; Sihes et al., 2017). Simple audio tools or printed QR codes linking to digital exercises can be introduced even in resource-limited classrooms (Abdul Rabu et al., 2019).

Finally, when adapting CALL for low-resource settings, open-source and free platforms should be prioritised to minimise financial barriers. These tools can be customised by local educators or developers to suit Arabic language requirements. Examples include modifying Moodle for Arabic instruction or adapting open-source voice recognition tools for script and pronunciation practice (Al-Qora'n et al., 2025; Dhouib et al., 2022).

In summary, to be effective in under-resourced South African contexts, CALL tools for Arabic must do more than merely replicate classroom materials digitally. They should be adaptable, accessible, and pedagogically sound, while actively addressing infrastructural and socio-economic issues. This necessitates collaboration among educators, technologists, and community stakeholders to ensure that the tools support learners not just as technology consumers but as active, empowered participants in their language learning journey.

Together, these adaptation strategies demonstrate that CALL can be designed to support Arabic learners in under-resourced contexts; however, their effectiveness ultimately depends on broader structural and pedagogical conditions. These conditions form the basis of the next theme, which examines the challenges and opportunities associated with implementing hybrid models in disadvantaged communities.

5.2 Challenges and Opportunities of Hybrid Arabic Language Instruction in Disadvantaged Communities

This theme explores both the structural constraints and pedagogical opportunities that shape hybrid Arabic language instruction. The implementation of a hybrid model, which combines traditional face-to-face teaching with digital resources, presents a promising approach to enhancing Arabic language learning in underprivileged South African communities. However, the success of this approach relies on overcoming both structural barriers and pedagogical challenges.

Some of the main challenges include infrastructure and connectivity gaps. Many under-resourced schools and madrasahs in South Africa lack reliable electricity, internet access, and modern devices (Czerniewicz & Brown, 2014). Even where mobile connectivity exists, data costs remain prohibitively high for low-income families, making consistent use of online tools difficult.

Teacher preparedness and digital literacy present further challenges. A major barrier to hybrid implementation is the limited digital training available to language teachers. Many Arabic instructors, especially those working in informal or religious settings, might not be familiar with CALL technologies or know how to incorporate them effectively using models like TPACK (Koehler & Mishra, 2009).

Curriculum misalignment in Islamic education presents another issue (Davids & Waghid, 2021). Existing Arabic curricula in South Africa often emphasise rote memorisation and traditional teaching methods. Incorporating digital tools without adjusting lesson objectives or content sequencing risks creating a gap between offline instruction and online reinforcement (Mohammed, 2022b).

We must also consider concerns related to equity and inclusion. If hybrid models are implemented without recognising local inequalities, they may worsen educational disparities by favouring digitally connected learners over others. Meaningful inclusion requires more than just device distribution; it demands cultural, linguistic, and pedagogical alignment (Warschauer, 2004).

On the other hand, hybrid learning offers many opportunities to learners of Arabic, including extended learning beyond the classroom. That is, hybrid models enable learners to access Arabic outside classroom hours, supporting asynchronous learning via mobile apps, podcasts, or recorded lessons (Mohammed, et al., 2021). This is particularly helpful in communities where formal Arabic classes are scarce in frequency or duration.

Furthermore, a hybrid approach offers pedagogical flexibility. Teachers can maintain traditional methods for foundational instruction (e.g., Quranic recitation, grammar rules), while digital tools support interactive practice (e.g., pronunciation, writing) and self-paced revision.

Moreover, hybrid learning models are well-suited for community and peer learning networks. Technology can facilitate peer-to-peer interactions, such as WhatsApp study groups, voice-note exchanges, or collaborative translation tasks. This aligns with Sociocultural Theory (Vygotsky, 1978), emphasising social learning as a central factor in language development. Similarly, hybrid models provide opportunities for local content creation such as community-led audio dictionaries or teacher-curated digital flashcards that reflect learners' cultural and linguistic backgrounds. This supports the Digital Equity Framework's call for relevance and ownership (Gorski, 2009).

Lastly, once adapted to local contexts, hybrid models can be scaled cost-effectively (Maloney et al., 2015). Open-source tools, once introduced and customised to the setting, can be reused and shared across schools, mosques, or community centres, reducing long-term costs and reliance on commercial platforms (Oussous et al., 2023).

Therefore, although infrastructure and digital literacy pose significant challenges, the hybrid model offers a practical, adaptable, and inclusive solution for teaching Arabic in disadvantaged communities. Success depends on contextual adaptation, support for teachers, and a commitment to equitable access, ensuring that technology enhances rather than replaces the social, cultural, and pedagogical richness of face-to-face learning.

While hybrid learning presents both significant barriers and promising opportunities, one of its most influential components is the integration of Web 2.0 tools. The next theme therefore explores how these tools enhance engagement and support learning outcomes in Arabic language classrooms.

5.3 The Role of Web 2.0 Tools in Enhancing Engagement and Learning Outcomes

This theme considers how Web 2.0 platforms contribute to engagement, collaboration, and skill development in Arabic learning environments. Web 2.0 tools such as blogs, wikis, podcasts, social media platforms, and collaborative forums have significantly transformed language learning by fostering learner interaction, content creation, and peer collaboration. In Arabic language classrooms, these tools possess considerable potential to enhance learner engagement and language development, especially when employed in ways that align with sociocultural theory and inclusive pedagogical models.

Web 2.0 tools enhance engagement through interactivity and personalisation. They facilitate active participation, enabling learners to transition from passive recipients to co-creators of content (Bingimlas, 2017). For example, Arabic learners can maintain blogs to practise writing in Modern Standard Arabic, join

forums or WhatsApp groups to share voice notes and ask questions, and use shared Google Docs or wikis to collaboratively develop vocabulary banks or grammar glossaries.

This shift promotes autonomy and ownership, which are two vital motivational factors in language learning (Deci & Ryan, 2000). The ability to personalise content and collaborate with peers also reflects Vygotsky's sociocultural emphasis on language learning as a socially mediated process (Vygotsky, 1978).

Furthermore, Web 2.0 tools can support the development of multiple skills in learners. These tools are inherently multimodal, allowing learners to enhance various abilities simultaneously. For Arabic, which faces difficulties in script, pronunciation, grammar, and diglossia, such tools offer diverse formats for engagement. Examples include videos and podcasts for listening and pronunciation, collaborative documents for grammar and writing, and chat-based platforms for real-time language interaction (Mohammed et al., 2020). This multimodality facilitates differentiated instruction, enabling learners to engage according to their preferred learning styles and language proficiency levels.

Additionally, Web 2.0 tools enable learners to engage with authentic Arabic media (Abdullahi et al., 2018) such as news articles, YouTube channels, and online communities, bridging the divide between classroom learning and real-world language use. This exposure enhances cultural understanding and contextualises vocabulary and grammar in a meaningful manner. It also encourages plurilingual awareness by connecting Arabic learning to learners' existing language skills.

Although few empirical studies have focused specifically on Arabic, research from other language contexts shows that Web 2.0 tools enhance engagement, collaboration, and language retention (Al-khresheh et al., 2025; Reinhardt & Thorne, 2011). Early evidence from Arabic CALL implementations indicates that student motivation and participation improve when learners use blogs, discussion forums, or multimedia tasks within blended learning environments (Mohammed, 2018).

In short, Web 2.0 tools greatly enhance learner engagement and support holistic language development in Arabic classrooms when implemented within an inclusive, pedagogically sound framework. However, their effectiveness in South Africa's under-resourced communities depends on overcoming access barriers and ensuring that tools are compatible with learners' linguistic, cultural, and technological contexts. Therefore, their full potential will only be realised through teacher training, resource adaptation, and community-led implementation strategies.

However, as shown earlier, although promising, the benefits of Web 2.0 tools are not universally accessible. In resource-limited South African contexts, learners may face restricted device access and data affordability, low digital literacy levels, particularly among Arabic instructors, and doubts about the reliability or suitability of open Web content.

Therefore, the effectiveness of these tools depends on contextual adaptation and support systems, as outlined in the Digital Equity Framework (Gorski, 2009). Teacher mediation, clear instructional design, and access to curated Arabic content are essential for maximising impact.

6 Conclusions

This study examined the potential role of CALL tools in teaching Arabic as a foreign language in South Africa, with a particular focus on inclusion and the digital divide. Grounded within a conceptual and theoretical framework, the research drew on Sociocultural Theory, the TPACK model, and the Digital Equity Framework to evaluate how technology can be effectively and equitably integrated into Arabic language education in under-resourced contexts. The analysis showed that while CALL tools offer valuable opportunities to enhance learner engagement, autonomy, and multimodal skills, their success in the South African context relies on adaptability, contextual adaptation, and fair access. Web 2.0 platforms, gamification environments, and AI-based tools can greatly improve language learning results, but only if infrastructural challenges, teacher readiness, and linguistic inclusivity are actively addressed.

The study promotes a hybrid model that combines traditional teaching methods with accessible digital tools, enabling Arabic language instruction to extend beyond the classroom while remaining sensitive to local socio-economic and educational conditions. This approach not only aligns with global trends in language education but also supports South Africa's broader objectives of digital transformation and social inclusion.

A hybrid learning model for Arabic language instruction should aim to include a variety of CALL tools while addressing ongoing challenges related to digital inequality, inclusivity, accessibility, and inconsistent connectivity. Traditional desktop-based software like Hot Potatoes and similar authoring tools can play a vital role in bridging the digital divide, as they require minimal internet access and operate effectively on low-specification devices. These tools provide dependable, offline learning options for students with limited connectivity or inconsistent access to online platforms. At the same time, integrating Web 2.0 tools such as wikis, blogs, and video-sharing sites can enhance learners' opportunities for collaboration and content creation. Ensuring that these platforms are lightweight, multilingual, and compatible with assistive technologies is essential for fostering accessibility and supporting learners with diverse abilities and technological constraints.

Integrating gamified learning environments and AI-based tools into this hybrid approach can further enhance inclusivity, provided their accessibility features and technical requirements are thoughtfully considered. Gamified platforms should offer adjustable difficulty levels, multimodal content, and mobile-friendly designs to accommodate diverse learners. Similarly, AI-driven systems, including chatbots and intelligent tutoring programmes, can support personalised learning but must be optimised for low-bandwidth

settings and feature clear, intuitive interfaces. When combined carefully, these tools create a flexible ecosystem that allows learners to engage meaningfully regardless of their socio-economic background, digital literacy, or connectivity challenges. This hybrid model not only advances Arabic language learning but also fosters more equitable and inclusive educational practices.

7 Limitations and Recommendations for Further Research

Given the conceptual nature of the research, the paper calls for empirical studies that explore the implementation of CALL tools in real-world classrooms, evaluate perceptions of learners and teachers, and investigate the development of localised Arabic CALL content. Future research should focus on community-driven, culturally sensitive, and mobile-compatible solutions that can bridge existing gaps and empower learners across diverse South African contexts. In addition, scientometric or bibliometric analyses of the use of CALL in teaching Arabic as a foreign language in South Africa and comparable global contexts are necessary to map research trends, spot gaps, and inform future innovations.

Ultimately, this research adds to the expanding body of scholarship on digital equity in language education by presenting a framework for inclusive, context-aware innovation. It views Arabic CALL not just as a technological upgrade but as a transformative educational opportunity rooted in pedagogy, access, and justice.

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