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Leveraging Artificial Intelligence and Digital Technologies to Enhance Sociolinguistic Competence and Arabic Language Skills

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Abstract. *Artificial Intelligence (AI) and digital technologies have revolutionized language education, providing new opportunities to enhance sociolinguistic awareness and Arabic language skills, including listening, speaking, reading, and writing. This study explores how AI-driven applications and digital platforms support learners in understanding and using various Arabic dialects alongside Modern Standard Arabic. The study uses a qualitative approach to analyse how these technologies bridge the gap between theoretical knowledge and practical communication. The study focuses on tools such as interactive chatbots, speech recognition systems, assistive technologies, virtual assistants, and language learning platforms. These tools align with the Common European Framework of Reference (CEFR) for Languages 2020 and Sustainable Development Goals 4 (SDG 4), highlighting their potential to promote inclusive and equitable language education. The study analyses how AI and digital tools contribute to Arabic learning and enhance communicative competence rather than involving testing or experiments. The findings suggest that these technologies offer significant potential for improving language proficiency and addressing diverse learners' needs.*

Keywords: *Artificial intelligence, digital tools, sociolinguistic competence, Arabic language skills, inclusive education.*

1. INTRODUCTION

The UNESCO Global Education Monitoring Report (2023) and related documents highlight the transformative role of technology and artificial intelligence (AI) in education, emphasizing equitable and inclusive integration while addressing challenges like access, governance, and teacher training. Reports on AI ethics (2021) (2022), stress the importance of ethical use, data privacy, and global collaboration to align with sustainable development goals. Initiatives like Digital Learning Week 2024 and Indonesia's Directorate of Learning and Student Affairs (Ditjendiktiristek, 2024) underscore the need for ethical strategies to enhance education quality and foster innovation.

These initiatives highlight the importance of ethical, inclusive, and collaborative approaches to integrating technology in education (Leta & Vancea, 2023). Aligning technology with equitable policies and sustainable practices (Vindigni, 2024), can bridge disparities and equip learners for a dynamic global future (Ahmad et al., 2024).

The advancement of AI and digital technologies is reshaping pedagogy, including language learning (Fountoulakis, 2024). Arabic language education particularly benefits by addressing challenges in teaching sociolinguistic competence—navigating dialects, registers, and cultural contexts—alongside linguistic proficiency (Morales et al., 2022). This study

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explores integrating AI and digital tools and sources into Arabic instruction to enhance sociolinguistic awareness and communication skills.

Teaching Modern Standard Arabic (MSA) and colloquial Arabic builds essential linguistic and cultural skills. Innovative tools, such as immersive and adaptive learning environments, enhance engagement across diverse sociolinguistic contexts (Abdelbary et al., 2023). Aligning Arabic language education with frameworks like CEFR (Europe, 2020) and Sustainable Development Goal 4 (SDG 4) highlights the need for inclusive, adaptive strategies to ensure accessibility and equity (Chalghoum, 2024).

Recent AI innovations, such as Neuralink's brain-computer interface (Kizi, 2022) or Brain-Chip-Interfaces (BCHIs) (Shaima et al., 2024), showcase the potential for personalized and immersive learning by connecting neural activity to digital platforms (Waisberg et al., 2024). However, ethical concerns, access disparities, and a lack of pedagogical frameworks present challenges (Adel et al., 2024) (Mohamed, 2024) (Silva et al., 2024). This study explores AI, web, and app tools to enhance learners' sociolinguistic competence and arabic language skills in listening, speaking, reading, and writing.

Building on this foundation, the research questions are: How do AI-driven tools and digital platforms contribute to the development of sociolinguistic competence in Arabic learners? What are the perceived strengths and limitations of existing AI and digital technologies in enhancing Arabic language skills (listening, speaking, reading, and writing)?

2. LITERATURE REVIEW

Recent studies highlight artificial intelligence’s role in language education (Maity & Deroy, 2024), focusing on its ability to create adaptive learning environments tailored to individual needs (Chicherina et al., 2024). AI-powered platforms, including intelligent tutoring systems and language apps, facilitate personalized learning through immediate feedback and customized lessons based on proficiency levels (Bhatia et al., 2024). These tools bridge the gap between formal instruction and real-world language use by simulating authentic environments for practicing communication skills (Dja'far, 2022) in diverse contexts (Hoter et al., 2024). Additionally, AI-driven speech recognition technologies enhance pronunciation and speaking skills (Vančová, 2023).

While AI can personalize and enhance language learning, critics argue it cannot replace human instructors (Klimova & Chen, 2024) or fully capture the social and cultural nuances of language use (Mananay, 2024) (Omer, 2024). This is especially critical for teaching

sociolinguistic competence, which extends beyond linguistic knowledge to understanding language variation across social, cultural, and situational contexts (Bérešová, 2022).

Sociolinguistics examines the interplay between language, culture, and society, emphasizing its relevance in Foreign Language Learning (FLT) and Second Language Acquisition (SLA) (Kurt, 2022). It focuses on contextual language use, including who, where, when, and how to speak (Kramsch, 1991). Developing sociolinguistic competence equips learners with linguistic skills and cultural awareness, enabling effective communication across diverse social contexts.

Sociolinguistic competence—the ability to use language appropriately in social contexts—is vital in language education (Canale & Swain, 1980). While traditional methods prioritized linguistic proficiency, its importance has grown, especially in languages with diverse dialects (Wardhaugh & Fuller, 2021) like Arabic. Teaching this competence requires exposing learners to the standard language and colloquial dialects, which vary in phonology, morphology, syntax, and vocabulary and are tied to cultural identities and social hierarchies (Trudgill, 2000).

Immersive experiences, such as study abroad programs, are key to building sociolinguistic competence (Meyerhoff, 2018); however, they are often inaccessible.. AI tools like chatbots and virtual partners now simulate real-world interactions, providing authentic dialogues and exposure to dialects (Saoudi & Gammoudi, 2023) (Shien, 2024) (Nabil et al., 2024). These tools help address gaps in Arabic instruction, which typically prioritizes Modern Standard Arabic over dialectal and sociolinguistic variation.

AI enhances sociolinguistic competence by adapting learning to real-world contexts, such as using speech analysis systems for feedback on pronunciation (Liu et al., 2023) and dialect nuances (Dalton & Keegan, 2017) (Al-Shenaifi et al., 2024). However, research often prioritizes linguistic proficiency over sociolinguistic competence (Fitts, 2001) (Geeslin, 2022).

The concept of sociolinguistic competence in the CEFR 2001 and CEFR 2020 shows continuity and change. CEFR 2001 provides a detailed explanation, highlighting elements such as expressions of folk wisdom (proverbs, idioms, etc.), linguistic markers of social relations (greetings, address forms, expletives), politeness conventions, register differences, and dialect and accent recognition (Europe, 2001). In contrast, CEFR 2020 omits the reference to expressions of folk wisdom and does not further elaborate on linguistic markers of social relations, politeness conventions, register differences, or dialect and accent (Europe, 2020), instead maintaining the original guidelines from the 2001 version. This shift simplifies the focus while retaining the core components of sociolinguistic competence.

3. METHODS

This study employs an archival technique (Lim, 2024) to collect materials from CEFR (2001), CEFR (2020), and Arabic learning platforms to support listening, speaking, reading, and writing in various formats such as websites, mobile apps, audio, video, and textual content. These materials are carefully selected to ensure they represent a broad spectrum of Arabic language learning frameworks and approaches. Subsequently, a thorough content analysis is conducted on the CEFR documents, comparing their key concepts in sociolinguistic competence.

This qualitative research promotes reflexivity and values subjectivity as a source of depth and insight, in addition to thriving on adaptability and flexibility (Lim, 2024). Through this approach, the study aims to capture the complexity of Arabic language learning in diverse contexts and to explore how these tools can be further developed to meet the sociolinguistic needs of learners, particularly those from multilingual and multicultural backgrounds.

4. RESULTS

1. Artificial Intelligence and Digital Tools for Arabic Dialects

a. Interactive Chatbots

Interactive chatbots in Arabic dialects have progressed significantly, addressing communication gaps with AI-driven solutions. In 2016, BOTTA, a dialect chatbot, was created using Egyptian Arabic. It features a female character designed for entertainment, developed with AIML, and launched on the Pandorabots platform. BOTTA's knowledge base includes AIML files (storing categories like greetings and nationality), set files (containing lists of words and phrases under themes like countries), and map files (linking words to values). For instance, if a user enters their name, BOTTA checks its files to determine gender and respond accordingly. Additionally, BOTTA handles Arabic spelling variations using orthographic normalization, like changing "ى" to "ي" (Al-Ghadhban & Al-Twairesh, 2020).

In comparison, Nabiha, another chatbot using Saudi Arabic, is designed to serve IT students and is available across multiple platforms like Android, Twitter, and the web.
In 2020, Nabiha was integrated into these platforms. During testing on *Pandorabots,* an issue occurred when a student asked, "How are you?" ("كفيك؟"). Although a category for "كفيك" existed in Nabiha's knowledge base, she didn't respond. The issue arose because the student typed the question with the punctuation mark "?" attached directly to the word, causing Nabiha to interpret the phrase as one word rather than two. As a result, Nabiha couldn't find the matching pattern. To fix this, the developers used a keyword matching approach and adjusted

for punctuation issues, allowing for more accurate responses (Al-Ghadhban & Al-Twairesh, 2020).

Additionally, based on the researcher's experience using Arabic ChatGPT, it communicates seamlessly in Saudi dialect, reflecting cultural nuances, idiomatic expressions, and informal conversational tone, such as "هلا والله" and "دامك طيبة هذا أهم شيء." This indicates a sophisticated understanding of colloquial language patterns. The model maintains a friendly and empathetic tone throughout the dialogue. It responds contextually to user inputs, offering personalized suggestions such as learning something new, taking a nature walk, or relaxing with a warm drink. This shows ChatGPT's ability to simulate human-like conversational flow and adapt to the user's moods.

The responses are culturally grounded, suggesting activities like engaging in ذكر (remembrance) or تسبيح (praise of God), which resonate with cultural and religious values in Saudi Arabia. This enhances relatability and user comfort. When the Researcher expresses disinterest in one set of ideas, ChatGPT quickly pivots to offer alternatives. This adaptability is key in maintaining user engagement and avoiding redundancy. Furthermore, the model uses expressions of encouragement and positivity, such as "الله يجعل يومك خفيف ولطيف مثلك," which fosters a supportive and warm conversational environment. ChatGPT maintains a high level of politeness, expressing gratitude and appreciation in response to the user's compliments, e.g., "تسلمين والله، هذا من طيبك!"

b. Automated Speech Recognition

The study on Automated Speech Recognition (ASR) for Arabic accents applied deep learning techniques to identify how Arabic accents influence English pronunciation (Habbash et al., 2024). Despite challenges, including high speaker fluency and similarity among certain accents, the model successfully highlighted distinct pronunciation patterns across different Arabic regions, particularly between Eastern (Jordan, Iraq, Saudi Arabia) and Western (Tunisia) Arab countries.

The tool recognizes Arabic accents using a deep learning approach with Mel spectrograms and an LSTM neural network. Audio recordings of English speech from speakers with different Arabic accents were transformed into Mel spectrograms to capture unique phonetic and temporal features. These spectrograms were then fed into the LSTM, which excels at analyzing sequential data, to identify accent-specific patterns. The model was trained to classify accents and showed a relatively high level of accuracy, performing particularly well in distinguishing more distinct accents, such as Tunisian versus Iraqi. Simplified binary

classification further improved accuracy by reducing inter-class similarities (Habbash et al., 2024).

Another research on automated speech recognition for Arabic accents focuses on identifying and classifying dialects such as Egyptian, Gulf, Levantine, Maghrebi, Iraqi, Yemeni, and Sudanese. These dialects are distinguished by phonological features like vowel length, intonation, and stress, in addition to syntactic and lexical variations influenced by regional languages such as Turkish and Persian. The methodology combines Convolutional Neural Networks (CNNs) to capture semantic and syntactic patterns and Recurrent Neural Networks (RNNs) to detect phonetic nuances like pronunciation. Feature engineering and language models, such as Word2Vec and GloVe, further enhance the process by vectorizing dialect-specific phrases for computational analysis (Alansari, 2023).

The six-stage framework begins with Natural Language Processing (NLP) techniques, including tokenization, part-of-speech tagging, and sentiment analysis. It is followed by clustering and classification to group and label dialects. Neural networks and optimization methods like gradient descent refine model performance, while evaluation metrics such as precision, recall, and F-score assess its accuracy. For example, phrases like "شو الأخبار؟" (Levantine for "what's new?") and "عامل إيه؟" (Egyptian for "how are you?") are identified and categorized effectively. This integrated approach leverages annotated audio datasets to achieve precise and reliable classification of Arabic dialects (Alansari, 2023).

c. Assistive Technologies

Localizing assistive technologies (AT) for Arabic dialects involves critical steps to ensure effectiveness and cultural alignment. This starts with addressing the diversity of Arabic, where words like طماطم (*tamātim*, "tomato") in Gulf Arabic differ from بندورة (*banadūra/bandūra*) in Egyptian Arabic, highlighting the need for dialect-specific adaptation. Cultural sensitivity is essential, incorporating Islamic values and privacy considerations to enhance user acceptance. Technical adjustments must address the Arabic script's right-to-left orientation, cursive nature, and diacritics, ensuring accurate text rendering. For instance, tools must interpret context-sensitive homographs like مفتوح(*mftūḥ*), which can mean "open" or "unlocked," depending on usage. Accessibility features, such as screen readers, must handle these complexities, while user-centric testing ensures the tools resonate linguistically and culturally. By collaborating with regional and global experts, AT solutions can achieve inclusivity and functionality, catering effectively to Arabic-speaking users (Elsheikh, 2023).

d. Virtual Assistants

The DALILA (Dialectal Arabic Linguistic Learning Assistant) is a Chrome extension designed to assist learners and non-native speakers in understanding texts written in Modern Standard Arabic (MSA) and Dialectal Arabic (DA). It leverages advanced Natural Language Processing (NLP) tools to analyze selected words. When a user highlights a word, DALILA processes it by segmenting it into potential prefixes, stems, and suffixes, and then validating these segments against a built-in dictionary. The tool selects the most likely interpretation based on probabilities and displays the analysis in a pop-up. This includes the English gloss (translation), part-of-speech tags, and morphological breakdown, making it easier for learners and non-native speakers to comprehend diverse Arabic dialects used in informal settings like social media. For instance, when a user selects the word ما بتفكرش, DALILA highlights it as a verb and provides a detailed breakdown. The analysis indicates that it means "you/they/she do(es) not think/consider/ponder" in the present tense, with the negative prefix (Khalifa et al., 2016).

Another tool is DIRA (Dialectal Arabic Information Retrieval Assistant), designed to address the challenges of retrieving information in Arabic, particularly in the context of Dialectal Arabic (DA) and Modern Standard Arabic (MSA). Given the increasing use of dialects in informal settings like social media, DIRA enables users to perform comprehensive searches by generating relevant lexical and morphological variations for their queries. This functionality is essential because dialects differ significantly from MSA in vocabulary, morphology, and orthography (Pasha et al., 2013).

DIRA processes it in three main stages. First, it translates the input into MSA or the selected Arabic dialect using a trilingual English-MSA-DA dictionary. For example, an English query like "see" might be translated into its dialectal equivalents, such as شاف(*shāf*) in Egyptian Arabic and Levantine Arabic. Second, DIRA expands these lemmas into various inflected forms using morphological analyzers. These expansions account for tense, gender, negation, and spelling variations, generating forms. Third, DIRA ranks these generated forms based on their frequency in large annotated corpora, ensuring that the most relevant variants appear first (Pasha et al., 2013).

2. Artificial Intelligence and Digital Tools for Arabic Language Skills

a. Listening Skill

Digital tools like AlifBee, Arabic for All, and ArabicPod101 offer diverse resources to improve Arabic listening skills. AlifBee, accessible via smartphones and its website, provides interactive exercises tailored to users' proficiency levels. With features like reminders,

gamified learning, and Pearson Assured certification, it ensures quality learning experiences. However, its focus on vocabulary and basic sentences may not sufficiently challenge advanced learners or provide opportunities for live interactions.

Arabic for All offers free native speaker audio lessons from *Al-'Arabiyyah Bayna Yadaik*. These lessons focus on pronunciation, vocabulary, and dialogues, allowing users to improve intonation and rhythm. Materials are downloadable for offline use and systematically organized by level. While ideal for foundational learning, its audio-only format and limited content make it less suitable for advanced learners seeking more complex material.

ArabicPod101 caters to a wide range of learners through its website, podcasts, and video content. Lessons include transcripts and subtitles to aid comprehension, along with features like progress tracking and section reviews. While it provides resources for all levels, its premium content requires payment, and advanced learners might find the focus on basic expressions limiting. Additionally, the use of English instruction and lack of Islamic cultural emphasis may not align with some learners' preferences.

b. Speaking Skill

Technology offers various tools for enhancing Arabic speaking skills, although options are fewer compared to English. Tools like Google Translate and Google Assistant provide foundational practice. With Google Translate, users can input spoken Arabic to receive text transcription, helping to identify pronunciation issues. While effective for basic practice, it lacks features for advanced feedback or conversational refinement. Google Assistant enables learners to engage in simple interactive dialogues in Arabic, offering real-time responses. However, its AI-driven interactions lack the depth and natural flow of communication with native speakers.

For a more immersive experience, Rosetta Stone uses its advanced speech recognition technology to evaluate and improve pronunciation. The platform integrates visual and auditory learning without relying on translation, promoting contextual understanding. Despite its effectiveness, the platform requires payment for full access and lacks the detailed feedback a human tutor could provide.

Additionally, HelloTalk connects learners with native Arabic speakers, enabling language exchange through voice messages, calls, and live sessions. It supports conversational fluency with features like text correction and 1-on-1 classes. While ideal for informal language practice, the platform's success depends on the user's consistency and engagement. Challenges such as time zone differences and limitations on free features may arise. These tools

collectively provide diverse approaches for improving Arabic speaking proficiency based on individual learning goals and dedication.

c. Reading Skill

Several digital tools, such as Tashkeel, Al-Jazeera Learning Arabic, and I Read Arabic, effectively support Arabic reading skill development. Tashkeel simplifies the process of adding harakat (vowel markers) to Arabic texts, enabling learners to read with proper pronunciation. While its interface is user-friendly and processes text swiftly, it requires a stable internet connection and redirects to another platform for text-to-speech functionality.

Al-Jazeera Learning Arabic provides reading materials tailored to different proficiency levels. Learners can practice by hiding and revealing harakat and testing their understanding through interactive quizzes with instant feedback. However, the platform's reliance on outdated materials and lack of direct interaction with native speakers can limit its appeal.

I Read Arabic offers a variety of digital books, narrated readings by native speakers, and quizzes to enhance comprehension. Users can record and review their readings to improve accuracy. With personalized learning content based on proficiency, it supports gradual skill development. However, premium subscriptions are required for certain features, and the platform's focus on reading and listening leaves limited support for speaking and writing. These tools offer diverse approaches to enhancing Arabic reading proficiency effectively.

d. Writing Skill

Several platforms, such as Write it! Arabic, Yamli Arabic Keyboard, and Lisan AI, offer practical tools to help beginners improve their Arabic writing abilities. Write it! Arabic is designed to teach the basics of writing Arabic letters through visual and audio guidance. Learners can practice by tracing letters, writing independently, and taking listening and writing tests to assess their progress. The intuitive interface and immediate feedback make it suitable for all age groups. However, its focus is limited to teaching letter formation, and accessing advanced lessons requires a paid subscription.

Yamli Arabic Keyboard simplifies typing in Arabic by allowing users to input words phonetically using Latin characters, which are then converted into Arabic script with real-time suggestions. This is particularly helpful for those unfamiliar with Arabic keyboards. However, occasional errors in transliteration, dependence on an internet connection, and the absence of advanced features such as grammar checks restrict its broader use, especially for advanced learners.

Lisan AI functions as a writing assistant that detects and highlights errors in spelling, grammar, and punctuation in Arabic text. It provides instant feedback, helping users identify and rectify common mistakes. However, it does not offer contextual analysis and requires an internet connection to function. Advanced features like integration with Microsoft Word are only available to premium subscribers.

5. DISCUSSION

1. The Role of Artificial Intelligence and Digital Tools in Developing Sociolinguistic Competence in Arabic: Benefits and Challenges

This study explores the benefits and challenges of using AI-driven chatbots like BOTTA, Nabiha, and Arabic ChatGPT in understanding Arabic dialects. A notable benefit is the ability of these tools to facilitate natural conversations, offering insights into how AI handles dialectal nuances, idiomatic expressions, and empathetic tones. These chatbots serve as effective pedagogical tools, providing practical exposure to spoken Arabic in informal learning settings.

However, challenges persist, including issues with punctuation errors, spelling variations, and a lack of cultural alignment. These highlight the need for a holistic approach that combines computational linguistics with an understanding of sociocultural contexts, as AI tools risk reinforcing inaccuracies and limiting their pedagogical effectiveness.

AI tools like Automatic Speech Recognition (ASR) systems have the potential to identify accent and dialectal patterns, enhancing sociolinguistic competence by helping learners understand phonological variations crucial for cross-cultural communication. Nevertheless, ASR struggles with distinguishing between closely related accents, indicating a need for more sophisticated algorithms that consider social factors such as gender and social status.

While ASR and chatbots contribute to sociolinguistic awareness, they often fall short in capturing the richness of Arabic dialects, especially those specific to rural or less urbanized regions. These technologies must incorporate dialectal diversity and account for sociocultural factors, such as Islamic norms, to serve the broader Arabic-speaking population, particularly learners with special needs.

The customization of these tools remains a significant challenge. However, assistive technologies (AT) hold promise, requiring rigorous testing and adaptation to address the diverse needs of Arabic-speaking communities. Ensuring cultural relevance is essential for

inclusivity and accessibility, which are key factors in achieving SDG 4 and aligning with the CEFR 2020 for inclusive education.

AI-driven tools like DALILA and DIRA, which bridge the gap between Modern Standard Arabic (MSA) and dialects by analyzing morphological structures and lexical variations, are valuable for informal contexts. However, their application in formal settings necessitates further refinement. Continued research is required to ensure these tools are adaptable across different contexts.

Despite their potential to develop sociolinguistic competence by addressing dialectal variation, cultural sensitivity, and practical communication skills, AI tools still face technical limitations and cultural misalignments. The development of more personalized tools that consider social and cultural factors is critical. Ongoing refinement of these technologies is essential to bridge the gap between formal language instruction and real-world usage, thereby supporting the goals of CEFR 2020 and SDG 4 for inclusive education.

2. Evaluating Artificial Intelligence and Digital Tools for Developing Arabic Language Skills: Strengths and Gaps

The tools reviewed show significant promise in supporting Arabic listening skill development, especially for beginners and intermediate learners. Platforms such as AlifBee and Arabic for All excel at providing foundational vocabulary and pronunciation practice. However, their focus on basic language skills limits their effectiveness for advanced learners who require more nuanced, context-rich listening materials. ArabicPod101 makes progress by incorporating multimedia content and interactive reviews; however, its reliance on English instruction diminishes the immersive experience essential for authentic language acquisition. A critical gap remains in these tools' inability to simulate real-world listening environments, which capture the complexity of Arabic dialects, intonation, and cultural references. To better serve learners, these platforms need to integrate region-specific dialogues, authentic media content, and live interaction features, allowing learners to navigate Arabic as it is used in diverse cultural and social contexts.

When it comes to speaking skills, the reviewed tools mainly focus on basic practice; however, they fail to foster advanced conversational fluency. Tools like Google Translate and Google Assistant provide functional assistance for beginners; nevertheless, they do not address the nuances of Arabic pronunciation, syntax, and pragmatics. Similarly, platforms like HelloTalk and Rosetta Stone introduce interactive features; however, their reliance on user engagement and subscription-based access limits their accessibility. The primary gap is the lack of tools capable of emulating natural conversations with contextual feedback.

Future AI-driven technologies should prioritize pronunciation accuracy, idiomatic usage, and culturally appropriate expressions, simulating real-life conversational scenarios. By incorporating sociocultural contexts, these tools will better prepare learners for meaningful, real-world interactions in Arabic.

In terms of reading skills, current tools offer structured support; however, they often fail to capture the linguistic diversity of Arabic. While Tashkeel is helpful for mechanical tasks such as vowel marking, it nevertheless overlooks the semantic richness found in literary and dialectal texts. Platforms like Al-Jazeera Learning Arabic and I Read Arabic provide structured learning; however, their reliance on static content and subscription models does not meet the evolving needs of learners aiming for higher-level literacy. A key gap is the lack of engagement with diverse Arabic text genres, including media, literature, and everyday documents. Effective tools should assist with mechanical tasks; however, they should equally help learners navigate the cultural and contextual layers of these texts. Adaptive learning algorithms that increase in complexity and incorporate cultural narratives would enhance learners' comprehension and contextual interpretation skills, allowing them to engage with Arabic as a living, dynamic language.

Regarding writing skills, the tools examined mainly address basic needs; however, they fall short of supporting advanced writing proficiency. Tools like *Write it! Arabic* and Yamli Arabic Keyboard simplify basic tasks such as letter formation and input methods; nevertheless, they lack the linguistic precision required for advanced writing.

While Lisan AI addresses some grammatical and syntactical issues, it does not provide the contextual analysis necessary for crafting cohesive, culturally appropriate texts in Arabic. The gap in writing tools is most evident at advanced levels, where a deeper understanding of syntax, rhetoric, and stylistic conventions is required. Future innovations must incorporate AI-driven contextual grammar analysis, collaborative writing platforms, and genre-specific aids to support academic, creative, and professional communication. By enhancing these tools with more sophisticated features, learners will be able to develop a more nuanced and authentic writing proficiency in Arabic.

3. Synthesis of Recommendations for Further Development

AI and digital tools for Arabic learners offer exposure to diverse dialects and regional variations, enriching language learning with authentic, context-rich dialogue. However, challenges remain in capturing the complexities of Arabic, such as gendered language and dialectal diversity, which may impade learning for other language speakers. Addressing these challenges necessitates integrating sociolinguistic insights and conducting user testing in

multilingual and multicultural environments to ensure tools are flexible and responsive to various dialects and cultural contexts.

AI and digital tools should align with learners' linguistic backgrounds and unique needs, incorporating sociocultural contexts to enhance real-world communication skills. By reflecting regional dialects, sociolinguistic variations, and practical scenarios, these tools can help learners achieve fluency, sociolinguistic competence, and a deeper understanding of Arabic across different registers. Content must adapt to the learner's proficiency level and contextual needs to ensure relevance, while interactive features like real-time feedback and live interactions are crucial for developing listening, speaking, reading, and writing skills.

Personalized feedback is essential for fostering sociolinguistic awareness. Tools should include region-specific idiomatic expressions and social registers to enhance cultural competence. Collaborative features like peer-to-peer interactions and group discussions can build confidence and foster community learning. Additionally, AI-driven systems must address variations in pronunciation, vocabulary, and grammar across Arabic dialects, enabling learners to navigate diverse social contexts.

Accessibility and inclusivity are critical. Tools should offer low-cost or free options and support multimodal learning approaches to accommodate different styles. Immersive technologies such as virtual reality (VR) and augmented reality (AR) can simulate real-life conversations, encouraging deeper engagement and interactive learning. Compatibility across various devices will further promote inclusivity, enabling broader participation.

Advancements in these tools will bridge the gap between language learning and practical communication. They will prepare learners to navigate modern multilingual environments, support sociolinguistic competence, and strengthen Arabic language skills. By addressing linguistic and cultural nuances, these tools will contribute to an effective and inclusive language learning experience.

6. CONCLUSION

Leveraging artificial intelligence (AI) and digital technologies to enhance sociolinguistic competence and Arabic language skills offers a transformative approach to language learning. AI-driven tools contribute to sociolinguistic competence by providing personalized content that accounts for dialectal and cultural variations, while enhancing language skills through real-time feedback and immersive experiences. Despite strengths in accessibility and inclusivity, challenges like affordability and cultural specificity remain. Artificial intelligence and digital

technologies are valuable tools; however, their impact depends on thoughtful integration and the support of skilled educators and learners.

LIMITATION

This study presents several limitations. It primarily focuses on the integration of technology without examining its long-term impact on learners' ability to apply the language in real-world settings. Furthermore, the availability of Arabic-language tools is limited, with many platforms lacking content tailored to specific Arabic dialects. The study excludes consideration of how individual learning styles may influence the effectiveness of these technologies. In addition, the study overlooks access and affordability challenges for learners in underserved communities, which may restrict the generalizability of the findings across diverse socio-economic backgrounds.

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