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Developing a Variety-Aware Mobile Learning Environment for Arabic Diglossia: A Design and Development Study

تطوير بيئة تعليمية متنقلة تراعي التنوع اللغوي لمعالجة الازدواجية اللغوية في العربية: دراسة في التصميم والتطوير

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ABSTRACT

This study employs an educational Research and Development (R&D) approach using design thinking phases to address the challenge of Arabic diglossia in digital learning environments. The outcome of this research is a conceptual model and prototype of an Arabic language learning mobile application named Dhou, which provides distinct yet integrated learning tracks for fusha and regional 'ammiyyah varieties. The proposed features combine contextual audiovisual materials, a progressive gamified learning path, and dialect-consistent conversational AI to bridge the sociolinguistic gap between formal competence and spontaneous everyday communication. This design and development study provides an empirical and practical basis for integrating variety-aware language instruction into mobile-assisted language learning.

Keyword	*Arabic diglossia;1, fusha and 'ammiyyah;2, Research and Development (R&D);3, Mobile-Assisted Language Learning (MALL);4, conversational AI;5*

مستخلص البحث

تستخدم هذه الدراسة منهجية البحث والتطوير (R&D) القائمة على مراحل التفكير التصميمي (Design Thinking) لمعالجة إشكالية الازدواجية اللغوية (Diglossia) في تعليم اللغة العربية عبر البيئات الرقمية. وتتمثل نتيجة هذه الدراسة في تطوير نموذج تصوري وتطبيقي لبيئة تعليمية متنقلة تدعى "ضوء (Dhou)"، توفر مسارات تعليمية متمايزة ومترابطة في آنٍ واحد لكلٍ من الفصحى واللهجات العامية. وتجمع الميزات المقترحة بين المواد السمعية البصرية السياقية، ومسار التعلم المنظم المحفز بالألعاب، وممارسة المحادثة التفاعلية عبر الذكاء الاصطناعي مع الحفاظ على اتساق اللهجة المختارة، مما يسهم في ردم الفجوة السوسيولغوية بين المعرفة الأكاديمية والتواصل اليومي الواقعي. يقدم هذا النموذج أساسا علميا وعمليا لدمج التنوع اللغوي الواعي ضمن تطبيقات تعلم اللغات المتنقلة

كلمات أساسية
الازدواجية اللغوية، الفصحى والعامية، البحث والتطوير (R&D)، التعلم النقال (MALL)، الذكاء الاصطناعي للمحادثة.

Introduction (المقدمة)

Arabic language learning presents a distinctive challenge for non-native learners because competence in formal Arabic does not necessarily result in readiness for everyday communication. Formal education commonly emphasizes fusha, particularly Modern Standard Arabic, which remains essential for literacy, academic communication, formal discourse, news, and written materials. Everyday communication across Arabic-speaking societies, however, frequently involves regional spoken varieties generally categorized as 'ammiyyah. This sociolinguistic relationship has long been discussed through the concept of diglossia, in which related varieties perform different social and communicative functions (Ferguson, 1959; Albirini, 2016).

For learners who later study, travel, or temporarily reside in Middle Eastern countries, the difference between formal and everyday Arabic can become practically significant. Previous knowledge of fusha provides an important linguistic foundation, but participation in daily communication may require familiarity with vocabulary, pronunciation, expressions, interactional patterns, and communicative conventions that receive less attention in formal learning environments. Research on Arabic diglossia similarly demonstrates that the relationship between standard and spoken Arabic has important educational consequences (Saiegh-Haddad, 2023; Thomure et al., 2025).

This does not mean that fusha should be replaced by 'ammiyyah. Formal Arabic remains central to literacy, academic communication, and communication across Arabic-speaking regions. The educational challenge concerns the transition between formal knowledge and communicative adaptation. Learners may possess a grammatical and lexical foundation in fusha while still requiring additional exposure to the spoken varieties used in everyday interaction. (Putri & Thoyyibah, 2024) similarly emphasize the relevance of both formal and spoken Arabic to communicative adaptability.

Mobile-assisted language learning creates new possibilities for responding to this gap. Mobile applications can combine audiovisual input, short exercises, listening practice, speech recording, repetition, feedback, progress tracking, and personalized review within one environment. Research on mobile-assisted and gamified language learning suggests that digital practice can support engagement and continuity when technological features remain aligned with meaningful educational objectives (Ishaq et al., 2021; Luo, 2023).

Existing digital language-learning applications demonstrate several useful approaches. Duolingo is widely associated with short progressive lessons, visible learning paths, immediate feedback, repeated practice, and gamification (Shortt et al., 2023). Cake app provides a complementary model through contextual audiovisual content, practical expressions, listening, pronunciation, repetition, and speaking-oriented activities (Paramita et al., 2022; Hardiana & Lubis, 2024; Sujana et al., 2024). Memrise is also relevant because its Arabic learning environment combines structured language learning, native-speaker video, and AI-supported conversation. These applications provide useful benchmarks, but Dhou is not intended to reproduce their proprietary interfaces.

Generative artificial intelligence creates an additional opportunity for the transition from knowledge to communication. Conversational AI can provide flexible interaction, immediate responses, and repeated practice without requiring another human conversation partner to remain continuously available. Reviews of generative AI in language education identify conversation, feedback, personalization, and interactive language production among its important affordances (Law, 2024; Yang & Li, 2024). However, generative systems may also produce inaccurate or inconsistent language, including unmarked switching among Arabic varieties.

Dhou therefore conceptualizes AI as a practice environment rather than the primary source of instructional contents. Human-reviewed audiovisual materials, vocabulary, learning activities, pronunciation models, and variety labels provide the verified instructional foundation, while AI provides a flexible environment for communicative practice.

Based on these considerations, this study utilizes a Research and Development (R&D) approach to design, develop, and evaluate Dhou, a variety-aware Arabic language learning mobile application organized around three principal components: video learning, a gamified learning path, and conversational AI. A review function supports learning continuity across these components. The architecture can be summarized as video learning → gamified learning path → conversational AI → review, or pedagogically as contextual input → structured practice → communicative production → reinforcement. The objective of this study is to develop the conceptual architecture and functional prototype of Dhou and to explain how learner needs, product benchmarking, audiovisual learning, gamified practice, Arabic-variety awareness, and conversational AI can be integrated coherently into an educational technology product.

Methods (منهجية البحث)

RESEARCH METHODOLOGY

This study adopts an educational Research and Development (R&D) design to construct the Dhou conceptual model and prototype. The development process

integrates the Design Thinking framework (Razzouk & Shute, 2012) into three systematic R&D phases: Needs Analysis, Pedagogical Design, and Prototype Development.

1.1 Phase 1: Needs Analysis (Analysis)

The analysis phase aimed to understand the sociolinguistic gap from two perspectives: the learner experience and the existing product environment.

- *Sociolinguistic Gap Exploration: An unmoderated online questionnaire was administered to students who had previously studied Arabic and experienced temporary residence in Middle Eastern countries. The responses highlighted a recurring gap: participants possessed foundational knowledge of fusha but struggled with the vocabulary, expressions, pronunciation, and communicative conventions of regional 'ammiyyah varieties encountered in daily interactions.*
- *Product Benchmarking: A comparative analysis of contemporary language-learning applications (Duolingo, Cake, Memrise) was conducted to evaluate existing mechanisms for structured progression, contextual video, and conversational AI. The analysis confirmed a lack of explicit Arabic-variety awareness (diglossia support) in current models.*
- *Problem Definition: The central R&D problem was formulated: How can a mobile learning application support learners transitioning from formal fusha to everyday spoken Arabic through contextual exposure, structured practice, and communicative opportunities?*

1.2 Phase 2: Instructional & Pedagogical Design (Design)

This phase transformed the design requirements into a sociolinguistically sensitive pedagogical architecture. The core design principle was to maintain clear distinctions between fusha and targeted 'ammiyyah varieties. The resulting model was structured into three principal components supported by a review function: Video Learning (contextual input), Gamified Learning Path (structured practice), and Conversational AI (communicative production).

1.3 Phase 3: Prototype Development (Development)

The pedagogical design was translated into a high-fidelity conceptual mobile prototype representing the Dhou application. An Arabic variety label functions as a system-wide attribute across all modules (Video, Learn, AI Conversation, Review) to prevent unguided code-switching and ensure linguistic consistency.

2. RESULT

2.1 Conceptual Architecture of Dhou

The primary R&D outcome is a conceptual learning architecture consisting of three principal learning environments supported by a review mechanism. The pedagogical sequence moves from sociolinguistic exposure to practice, production, and reinforcement.

- *Video Learning: Contextual language input (Observe, listen, notice, and understand).*

- *Gamified Learning Path: Structured language practice (Recognize, retrieve, construct, pronounce, and reinforce).*
- *Conversational AI: Communicative language production (Formulate, respond, interact, and maintain communication).*
- *Review: Learning reinforcement (Revisit, correct, repeat, and consolidate).*

Picture 1: Gamified Learning Path | Picture 2: Video Learning Interface | Picture 3: Conversational AI Interface

2.2 Video-Based Contextual Learning

Video Learning provides audiovisual exposure to Arabic within communicative contexts, clearly indicating whether the material uses fusha or a supported regional 'ammiyyah variety. Pedagogical functions include Arabic subtitles, interactive transcripts, vocabulary/expression extraction, sentence-level replay, shadowing, and record-and-compare features.

2.3 Gamified Learning Path

The gamified learning path organizes language practice progressively. Gamification provides motivational support through progress visualization, while the activities (vocabulary learning, sentence arrangement, audio-to-text dictation, shadowing) move learners from recognition toward controlled production. Arabic-variety information remains visible throughout the learning path.

2.4 Conversational AI

Conversational AI provides opportunities to use Arabic interactively. Before starting, the learner selects the Arabic variety (fusha or a supported 'ammiyyah variety). The system is designed to maintain variety consistency, acting as a practice environment rather than the primary source of instructional content.

2.5 Review and Learning Continuity

Review forms the reinforcement layer, allowing vocabulary, errors, and interactional difficulties to be revisited. The complete cycle is: Contextual Exposure → Structured Practice → Communicative Production → Review → Repeated Use.

Results & Discussion (نتائج البحث ومناقشاتها)

Learner Problem: Fusha and Everyday Communication

The findings suggest that the central problem is the sociolinguistic gap between formal competence and communicative readiness in diglossic environments. The R&D process shifts the design focus from teaching Arabic entirely from the beginning toward supporting the transition from previously acquired formal knowledge to flexible communicative competence. This aligns with sociolinguistic research emphasizing the functional differentiation of Arabic varieties (Ferguson, 1959; Albirini, 2016) and the educational consequences of diglossia (Saiegh-Haddad, 2023; Putri & Thoyyibah, 2024).

Integration of AI and Contextual Learning in Arabic Diglossia

Dhou's contribution lies in the integration of its features tailored specifically to Arabic diglossia. Video Learning provides essential contextual exposure to pronunciation, rhythm, and sociolocultural context. The Gamified Learning Path

ensures structured retention. Conversational AI extends this into active production. Crucially, AI is constrained by variety consistency to prevent unmarked code-switching, which can confuse learners. The explicit labeling of fusha and 'ammiyyah throughout the app mitigates this confusion, ensuring learners understand the sociolinguistic context of the language they are producing.

Limitations and Future R&D Cycles

As an early-stage R&D prototype, the current iteration is limited to conceptual design and prototype development, which requires further empirical evaluation to assess interface comprehension and longitudinal learning outcomes. Future development cycles will refine interface elements (e.g., Review function visibility) and conduct broader evaluations of the AI's variety consistency and pedagogical effectiveness over time. The initial scope is deliberately limited to fusha, Egyptian Arabic, and Levantine Arabic to ensure linguistic reliability before expanding to other regional varieties

Conclusions (الخاتمة)

This Research and Development study proposes Dhou as a variety-aware educational technology prototype that addresses Arabic diglossia by integrating contextual video learning, structured gamified practice, and dialect-consistent conversational AI. Future R&D efforts will focus on pedagogical validation and the expansion of curated linguistic content to further bridge the gap between formal Arabic education and real-world communication.

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