



Beyond Textbooks: Designing AI-Augmented Arabic Teaching Materials for Personalized Learning in Higher Education

Muh. Sabilar Rosyad ^{1*}, Laila Farah Fitria ²

¹ Universitas Islam Negeri Sunan Kalijaga Yogyakarta

² Universitas Islam Negeri Sunan Ampel Surabaya

Article History:

Received: 2026-06-09

Revised: 2026-06-28

Accepted: 2026-07-12

Published: 2026-07-31

Keywords:

Adaptive Learning; Arabic Language Teaching Materials; Artificial Intelligence in Language Education; Materials Development Theory; Personalized Learning.

* Correspondence Address:

muhammad.rosyad@uin-suka.ac.id

Abstract: The growing adoption of artificial intelligence (AI) in language education has created new opportunities for personalized learning while simultaneously challenging conventional approaches to instructional materials development. Despite increasing research on AI-assisted language learning, limited attention has been given to the design of AI-augmented Arabic teaching materials. This study aims to identify the design principles of effective AI-enhanced Arabic instructional materials and to develop a conceptual framework for future materials development. Employing a Systematic Conceptual Review of 52 peer-reviewed studies retrieved from Scopus and Web of Science (2017-2026), the study synthesized recurring themes through thematic analysis to identify design principles and develop a conceptual framework. The thematic synthesis identified eight interrelated design principles, including pedagogically guided AI integration, learner-centered personalization, adaptive content sequencing, and human-AI collaborative learning. Based on these principles, the study proposes the AI-Augmented Arabic Teaching Materials Framework (AI-AATM), a five-layer model integrating learner, AI, materials, pedagogical, and learning experience dimensions. The study extends Materials Development Theory by reconceptualizing instructional materials as intelligent, adaptive, and learner-responsive ecosystems, while providing a theoretically grounded framework for future AI-enhanced Arabic language materials development and research.

INTRODUCTION

The rapid advancement of digital technologies has fundamentally reshaped the landscape of language education. Over the past decade, language learning has gradually moved beyond traditional classroom boundaries toward digitally mediated environments that support interaction, flexibility, and learner autonomy. This transformation has been further accelerated by the emergence of artificial intelligence (AI), which has introduced unprecedented possibilities for adaptive instruction, personalized learning pathways, and intelligent educational support systems (Holmes et al., 2019; Kohnke et al., 2023). As a result, instructional materials are no longer viewed merely as static repositories of linguistic knowledge but increasingly as dynamic learning resources capable of responding to learners' individual needs, preferences, and learning trajectories. Recent developments in generative AI, learning analytics, and intelligent tutoring systems have reinforced this shift, enabling educational content to be continuously adapted and refined based on learner characteristics and performance data (Kasneci et al., 2023; Tlili et al., 2023).

These developments have significant implications for language teaching materials, which remain one of the most influential components of language learning environments. Within higher education, language teaching materials serve not only as sources of linguistic input but also as pedagogical tools that shape learning experiences, instructional practices, and learner

engagement. Nevertheless, despite ongoing technological innovations, Arabic language teaching materials continue to be predominantly textbook-oriented. In many Arabic as a Foreign Language (AFL) and Arabic as a Second Language (ASL) programs, printed textbooks remain the primary instructional resource, often providing standardized content and fixed learning sequences designed for broad groups of learners rather than for individual learning needs (Alnassan, 2017; Moser, 2021). While such materials contribute to curricular consistency, they frequently offer limited opportunities for personalization, adaptive progression, and differentiated learning support.

The limitations of conventional Arabic teaching materials have become increasingly evident in contemporary higher education contexts characterized by diverse learner backgrounds, learning goals, and proficiency levels (Fauzan, 2010; Rosyad, Rosyadi, et al., 2026). Previous studies have identified several persistent challenges, including limited exposure to authentic language use, insufficient communicative practice, and difficulties accommodating learners' varying linguistic needs (Arkan, 2026; Bahhari & Willoughby, 2026; Kamal, 2025; Qpilat & Alhosani, 2026; Zulhannan et al., 2025). These challenges are particularly pronounced in AFL and ASL contexts, where learners often enter instructional settings with highly heterogeneous experiences, motivations, and expectations. Consequently, the growing diversity of Arabic language learners calls for instructional materials that are more flexible, responsive, and capable of supporting individualized learning pathways.

Recent advances in artificial intelligence offer promising opportunities to address these challenges. The emergence of generative AI technologies has enabled the creation of contextualized learning content, personalized language exercises, and adaptive instructional support at an unprecedented scale. Large language models can generate authentic texts, facilitate interactive language practice, and provide immediate feedback tailored to learners' proficiency levels and learning objectives (Kasneci et al., 2023). Similarly, adaptive learning systems can analyze learner performance and dynamically adjust instructional content, while learning analytics tools allow educators to monitor learning progress and identify individual learning needs. Such developments have stimulated growing interest in AI-supported language learning environments capable of enhancing learner engagement, autonomy, and personalization (Crompton & Burke, 2023; Kohnke et al., 2023).

However, the rapid adoption of AI technologies has also exposed an important conceptual challenge within language education research. Much of the existing literature has focused on evaluating specific AI tools, examining learners' perceptions of generative AI, or investigating the effectiveness of AI-assisted writing and tutoring applications (Kasneci et al., 2023; Tlili et al., 2023). While these studies have significantly expanded understanding of AI-mediated learning, they have devoted comparatively little attention to the pedagogical design of AI-enhanced teaching materials themselves. In other words, researchers have extensively explored what AI can do, but considerably less attention has been given to how language teaching materials should be designed to incorporate AI in pedagogically meaningful ways.

This limitation is particularly evident in the field of Arabic language education. Although research on technology-enhanced Arabic learning has gradually increased, studies explicitly addressing the design of AI-augmented Arabic teaching materials remain scarce. Existing investigations tend to focus on technology adoption, online learning platforms, or digital language learning tools rather than on the underlying principles that should guide the development of AI-enhanced instructional materials. Furthermore, the literature lacks a comprehensive conceptual framework capable of explaining how AI functionalities, learner

characteristics, pedagogical principles, and instructional materials can be systematically integrated within Arabic language learning environments. As a result, the field currently possesses limited theoretical guidance for designing Arabic teaching materials that effectively leverage the affordances of AI.

Addressing this challenge requires revisiting established theories of materials development. Traditional Materials Development Theory emphasizes learner-centeredness, authenticity, flexibility, and meaningful engagement as key principles for effective instructional materials (Alam, 2025; Grewal et al., 2024; McGrath, 2016; Tomlinson, 2023). While these principles remain highly relevant, the emergence of AI introduces new possibilities that extend beyond conventional conceptions of instructional materials. AI-supported materials can generate content dynamically, adapt learning sequences in real time, provide personalized feedback, and facilitate continuous learner support. These capabilities suggest a theoretical transition from static materials toward intelligent materials characterized by adaptivity, personalization, and responsiveness. Understanding this transition requires integrating insights from Materials Development Theory, Personalized Learning Theory, Sociocultural Theory, Cognitive Load Theory, Multimodality Theory, and emerging scholarship on AI in Education. Together, these perspectives offer a comprehensive lens through which AI-enhanced Arabic teaching materials can be conceptualized and designed.

Against this background, a significant gap remains in the literature. Although previous studies have examined AI tools, ChatGPT-assisted learning, AI-supported writing, and intelligent tutoring systems, little is known about the design principles that characterize effective AI-augmented Arabic teaching materials. Likewise, no comprehensive conceptual framework currently exists to guide future development of AI-enhanced Arabic instructional materials. The absence of such theoretical guidance limits both scholarly understanding and practical implementation of AI within Arabic language education.

To address these gaps, this study makes three primary contributions. First, it identifies a set of design principles that characterize effective AI-augmented Arabic teaching materials. Second, it proposes the AI-Augmented Arabic Teaching Materials Framework (AI-AATM), a conceptual model intended to guide future development of AI-enhanced Arabic learning resources. Third, it extends traditional Materials Development Theory by incorporating the concepts of adaptivity, personalization, and responsiveness enabled by artificial intelligence technologies. Through these contributions, the study seeks to establish a theoretical foundation for future research and practice in AI-enhanced Arabic language education.

This study seeks to advance the emerging field of artificial intelligence integration in Arabic language education by pursuing two main objectives. First, it aims to identify and conceptualize the core design principles that underpin effective AI-augmented Arabic teaching materials, drawing upon contemporary perspectives in language pedagogy, educational technology, and human-centered learning design. Second, it aims to develop a comprehensive conceptual framework—the AI-Augmented Arabic Teaching Materials (AI-AATM) Framework—that can guide the systematic design, implementation, and evaluation of future AI-enhanced Arabic instructional resources. By addressing these objectives, the study contributes to the theoretical foundation of AI-assisted language learning and provides a structured reference for researchers, curriculum designers, and educators seeking to leverage artificial intelligence in Arabic language teaching and learning.

To guide the conceptual synthesis and framework development, this study addresses the following research questions: (1) What pedagogical and theoretical design principles characterize effective AI-augmented Arabic teaching materials for personalized learning in higher education? (2) How can these principles be synthesized into a comprehensive conceptual framework to guide the systematic development of AI-enhanced Arabic teaching materials? By explicitly addressing these research questions, the study establishes a coherent analytical pathway linking the identified literature, thematic synthesis, and conceptual framework development, thereby strengthening the theoretical rigor and methodological transparency of the proposed AI-Augmented Arabic Teaching Materials Framework (AI-AATM).

METHOD

This study employed a Systematic Conceptual Review (SCR) design to identify the fundamental design principles of AI-augmented Arabic teaching materials and to develop a conceptual framework for future materials development. Unlike traditional literature reviews that primarily summarize existing findings, a systematic conceptual review seeks to synthesize fragmented knowledge, uncover underlying theoretical patterns, and generate new conceptual understandings (Jaakkola, 2020; Snyder, 2019). This approach was considered appropriate because the objective of the study was not to evaluate the effectiveness of a particular instructional intervention but to construct a theoretically grounded framework that integrates insights from Arabic language education, materials development, personalized learning, and artificial intelligence in education.

The review process followed a structured and transparent procedure involving literature identification, screening, thematic synthesis, conceptual integration, and framework construction. Through this process, the study sought to generate conceptual contributions that extend existing theories of materials development into AI-enhanced learning environments.

The literature corpus was retrieved from Scopus and Web of Science databases. Detailed information regarding data sources, search strategy, eligibility criteria, and screening procedures is presented in Table 1. These databases were selected because they provide extensive coverage of high-quality research in language education, educational technology, artificial intelligence in education, and instructional design.

Table 1. Literature Search Protocol and Eligibility Criteria

Component	Description
Research Design	Systematic Conceptual Review (SCR)
Databases	Scopus; Web of Science (WoS)
Publication Period	2017–2026
Language	English
Document Type	Peer-reviewed journal articles
Journal Quality	Scopus/WoS indexed journals
Primary Focus Areas	Arabic Language Teaching Materials, Materials Development, Artificial Intelligence in Education, Personalized Learning, Adaptive Learning, Educational Technology
Search Keywords	“Arabic language teaching materials”; “Arabic language learning materials”; “materials development”; “AI in language education”; “artificial intelligence in language learning”; “generative AI”; “adaptive learning”; “personalized learning”; “learning analytics”; “intelligent tutoring systems”
Search Operators	Boolean operators (AND, OR)
Inclusion Criteria	(1) Peer-reviewed journal articles; (2) Published between 2017–2026; (3) Written in English; (4) Indexed in Scopus or Web of Science; (5) Published in Q1/Q2/Q3/Q4 journals; (6) Relevant to language teaching materials, AI in education, adaptive learning, personalized learning, or Arabic language education
Exclusion Criteria	(1) Conference proceedings; (2) Book reviews; (3) Editorials; (4) Opinion papers; (5) non-English publications; (6) Duplicate records; (7) Studies unrelated to AI-supported language learning materials
Screening Procedure	Title screening → Abstract screening → Full-text review
Analytical Technique	Thematic Analysis
Analytical Focus	Recurring concepts, design principles, theoretical constructs

Output	Design Principles for AI-Augmented Arabic Teaching Materials and AI-Augmented Arabic Teaching Materials Framework (AI-AATM)
--------	---

The literature search was conducted systematically following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) reporting framework to ensure transparency throughout the identification and screening process. Searches were performed in Scopus and Web of Science using the predefined search strings presented in Table 1. The initial search identified 412 records (Scopus = 286; Web of Science = 126). After removing 54 duplicate records, 358 articles remained for title and abstract screening. Subsequently, 281 studies were excluded because they did not meet the inclusion criteria, including studies focusing solely on AI tools without materials development, conference proceedings, editorials, book reviews, and studies unrelated to language teaching materials. The remaining 77 full-text articles were assessed for eligibility. Following full-text evaluation, 25 articles were excluded because they did not provide sufficient conceptual relevance to AI-supported Arabic teaching materials or materials development. Consequently, 52 studies were included in the final thematic synthesis and conceptual analysis that informed the development of the proposed AI-Augmented Arabic Teaching Materials Framework (AI-AATM).

The search process employed a combination of keywords related to Arabic language education, materials development, artificial intelligence, adaptive learning, and personalized learning. The complete search protocol is summarized in Table 1. To ensure conceptual relevance and methodological rigor, explicit inclusion and exclusion criteria were established prior to the screening process (see Table 1).

The final corpus of included studies served as the basis for the thematic analysis, through which recurring concepts, pedagogical principles, and theoretical constructs were identified and synthesized to answer the research questions (Braun & Clarke, 2021; Creswell & Creswell, 2017). Thematic analysis was employed because it enables researchers to move beyond descriptive summaries and identify deeper conceptual structures underlying diverse research findings.

The analysis proceeded through several iterative stages. First, all selected articles were read in full to gain familiarity with the literature. Second, relevant concepts, theoretical propositions, design recommendations, and pedagogical considerations were extracted and coded. Third, similar codes were grouped into broader conceptual categories. Fourth, recurring themes were identified across studies and compared against existing theoretical perspectives.

Particular attention was given to three analytical dimensions: (1) Recurring concepts related to AI-supported language learning materials; (2) Design principles associated with effective instructional materials; (3) Theoretical constructs explaining the interaction between learners, instructional materials, and AI technologies. The resulting themes served as the foundation for generating design principles and constructing the proposed conceptual framework.

The development of the AI-Augmented Arabic Teaching Materials Framework (AI-AATM) followed a four-stage conceptual synthesis process as below:

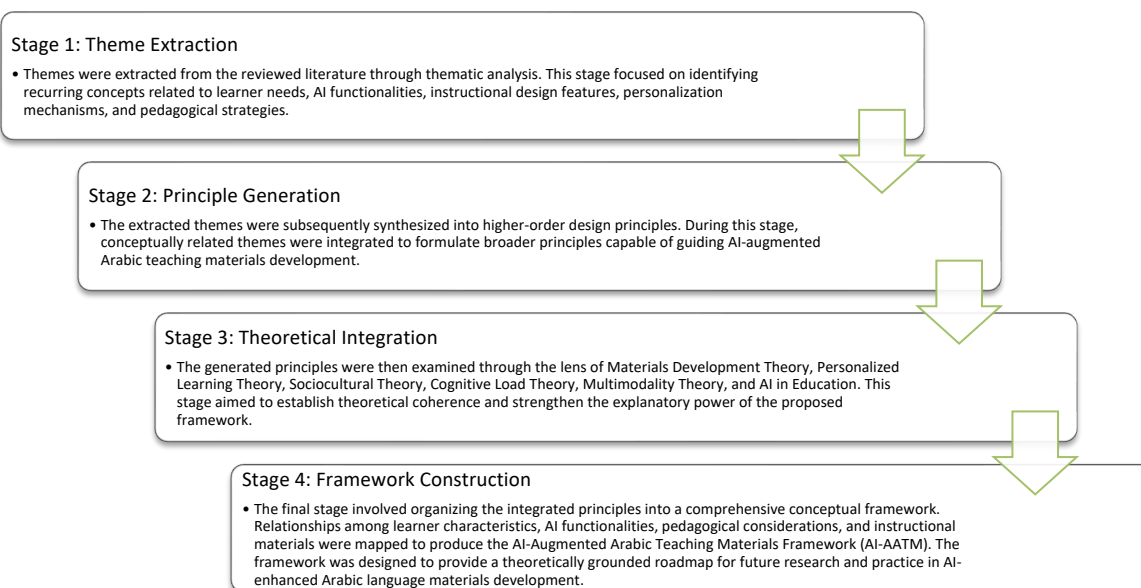


Figure 1. Framework Development Procedure

RESULTS | نتائج | TEMUAN

Design Principles for AI-Augmented Arabic Teaching Materials

The thematic analysis of the selected literature revealed eight interrelated design principles that characterize effective AI-augmented Arabic teaching materials. These principles emerged consistently across studies on materials development, artificial intelligence in education, personalized learning, educational technology, and language pedagogy. Together, they provide a conceptual foundation for designing Arabic learning materials that move beyond static textbook paradigms toward intelligent, adaptive, and learner-responsive learning environments.

Principle 1: Pedagogically Guided AI Integration

The analysis indicates that AI should be integrated as a pedagogical enabler rather than as a technological add-on. Effective AI-supported materials are guided by clear learning objectives, pedagogical rationales, and language learning outcomes. AI functionalities such as content generation, automated feedback, and adaptive recommendations should support established instructional approaches rather than replace pedagogical decision-making. Consequently, technology integration must remain subordinate to pedagogical goals and learner needs.

Principle 2: Learner-Centered Personalization

Personalization emerged as one of the most frequently discussed themes in the literature. AI-enhanced materials should accommodate differences in learners' proficiency levels, learning preferences, motivations, and learning goals. Through adaptive algorithms and learner profiling, instructional materials can provide differentiated content, individualized learning pathways, and customized learning experiences. This principle reflects the growing shift from standardized instruction toward personalized learning ecosystems.

Principle 3: Adaptive Content Sequencing

Traditional instructional materials typically follow fixed content sequences. In contrast, AI-supported materials can dynamically adjust learning progression according to learner performance and engagement patterns. Adaptive sequencing enables learners to receive content

that aligns with their current proficiency and learning readiness. Such flexibility is particularly relevant in Arabic language learning, where learners often demonstrate varying levels of linguistic competence and prior knowledge.

Principle 4: Authentic Arabic Language Exposure

Authenticity remains a central principle in materials development. The analysis suggests that AI can facilitate access to authentic Arabic language resources by generating contextually relevant texts, dialogues, communicative tasks, and culturally situated learning scenarios. Rather than relying solely on simplified textbook examples, learners can engage with language that more closely reflects real-world communication. Authentic exposure contributes to communicative competence and enhances learners' understanding of contemporary Arabic language use.

Principle 5: AI-Supported Scaffolding

Scaffolding represents another recurring principle identified in the literature. AI technologies can provide immediate explanations, hints, corrective feedback, vocabulary support, and guided practice. Such scaffolding functions help learners overcome linguistic challenges while maintaining appropriate levels of cognitive engagement. Importantly, scaffolding should be adaptive and responsive to learner performance rather than uniformly applied across all learners.

Principle 6: Multimodal Learning Design

The reviewed literature consistently emphasizes the importance of multimodal learning environments. Effective AI-augmented Arabic materials should integrate multiple modes of representation, including text, audio, visual resources, interactive exercises, and conversational interfaces. The combination of multiple modalities can enhance comprehension, reduce cognitive barriers, and support diverse learning preferences. This principle is particularly relevant for Arabic language learning, where listening, pronunciation, script recognition, and contextual understanding often require multimodal instructional support.

Principle 7: Ethical and Responsible AI Use

Ethical considerations emerged as a significant concern in contemporary AI research. AI-supported instructional materials should ensure transparency, fairness, privacy protection, and responsible use of learner data. Developers must also address issues related to algorithmic bias, content accuracy, and overreliance on automated systems. Ethical AI integration is essential to maintaining trust, accountability, and educational integrity within AI-enhanced learning environments.

Principle 8: Human-AI Collaborative Learning

The final principle emphasizes the complementary relationship between human expertise and artificial intelligence. The literature consistently rejects the notion that AI should replace teachers or instructional designers. Instead, effective AI-supported materials position AI as a collaborative partner that enhances instructional effectiveness while preserving the central role of human judgment, pedagogical expertise, and social interaction. Human-AI collaboration therefore becomes a defining characteristic of future language learning ecosystems.

Collectively, these principles suggest that AI-augmented Arabic teaching materials should be viewed not merely as technologically enhanced resources but as intelligent pedagogical systems that integrate personalization, adaptivity, authenticity, and human-centered learning.

Although the identified principles and the AI-Augmented Arabic Teaching Materials Framework emerged consistently from the thematic synthesis of the reviewed literature, they should be interpreted as conceptual rather than empirical findings. The proposed framework is intended to provide a theoretically informed foundation for future AI-enhanced Arabic materials development, while its structural relationships and pedagogical assumptions remain open to empirical examination and validation in authentic educational settings.

Table 2. Design Principles for AI-Augmented Arabic Teaching Materials

Principle	Description	Supporting Literature
Pedagogically Guided AI Integration	AI functions are aligned with pedagogical objectives and learning outcomes.	(Holmes & Miao, 2023; Kasneci et al., 2023)
Learner-Centered Personalization	Materials adapt to learners' needs, goals, and proficiency levels.	(Kohnke et al., 2023; Pane et al., 2017)
Adaptive Content Sequencing	Learning pathways are dynamically adjusted based on learner performance.	(Luckin & Holmes, 2016; Zawacki-Richter et al., 2019)
Authentic Arabic Language Exposure	AI facilitates access to authentic language input and communicative contexts.	(Mishan, 2015; Tomlinson, 2023)
AI-Supported Scaffolding	AI provides adaptive support, feedback, and guidance.	(Holmes & Miao, 2023; Lantolf et al., 2020)
Multimodal Learning Design	Multiple modes of representation support learning.	(Mayer, 2002; Reyes-Torres et al., 2025)
Ethical and Responsible AI Use	AI implementation prioritizes transparency, fairness, and privacy.	(Tlili et al., 2023; UNESCO, 2021)
Human-AI Collaborative Learning	AI complements rather than replaces human teaching.	(Holmes & Miao, 2023; Kasneci et al., 2023)

AI-Augmented Arabic Teaching Materials Framework (AI-AATM)

Building upon the identified design principles, a conceptual framework termed the AI-Augmented Arabic Teaching Materials Framework (AI-AATM) was developed. The framework integrates key theoretical constructs extracted from the literature and provides a systematic model for future Arabic materials development in AI-enhanced learning environments.

The framework consists of five interconnected layers: Learner Layer, AI Layer, Materials Layer, Pedagogical Layer, and Learning Experience Layer. These layers collectively illustrate how learner characteristics, AI functionalities, instructional materials, pedagogical approaches, and learning experiences interact within personalized Arabic language learning environments.

Layer 1: Learner Layer

The Learner Layer serves as the foundation of the framework. This layer includes three primary dimensions: proficiency, goals, and needs. Learners enter instructional settings with varying levels of Arabic language competence, diverse learning objectives, and unique educational backgrounds. Effective materials development must therefore begin with a comprehensive understanding of learner characteristics.

The framework assumes that personalization is only possible when instructional decisions are informed by accurate learner profiles. Consequently, learner data become the starting point for adaptive content delivery and instructional decision-making.

Layer 2: AI Layer

The second layer consists of AI functionalities that support personalization and adaptivity. Four core functions emerged from the literature: (1) Content generation; (2) Recommendation systems; (3) Intelligent feedback; (4) Learning analytics

Content generation enables the creation of customized learning resources. Recommendation systems guide learners toward relevant learning activities. Intelligent feedback provides immediate support and corrective guidance. Learning analytics continuously monitor

learner performance and generate actionable insights for adaptation. Together, these functions transform AI from a passive technological tool into an active component of the instructional ecosystem.

Layer 3: Materials Layer

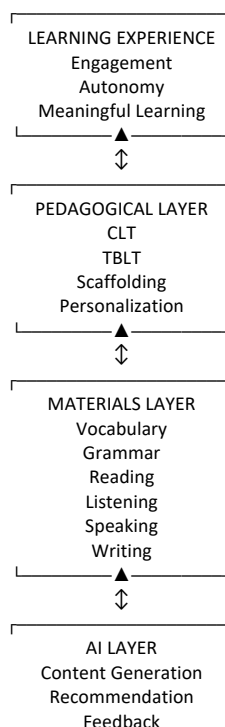
The Materials Layer represents the instructional content delivered to learners. Six core components were identified: (1) Vocabulary; (2) Grammar; (3) Reading; (4) Listening; (5) Speaking; (6) Writing. Unlike traditional textbooks, these materials are not static. Instead, they can be dynamically modified according to learner characteristics and AI-generated recommendations. The framework therefore conceptualizes materials as flexible learning resources that continuously evolve throughout the learning process.

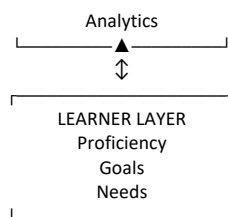
Layer 4: Pedagogical Layer

The Pedagogical Layer ensures that technological innovation remains grounded in educational theory. Four pedagogical components form this layer: (1) Communicative Language Teaching (CLT); (2) Task-Based Language Teaching (TBLT); (3) Scaffolding; (4) Personalization. These pedagogical principles shape how AI functionalities are translated into meaningful learning experiences. The framework explicitly rejects technology-driven design and instead promotes pedagogy-driven AI integration.

Layer 5: Learning Experience Layer

The final layer represents the intended outcomes of AI-enhanced materials. Three dimensions emerged consistently across the literature: (1) Engagement; (2) Autonomy; (3) Meaningful Learning. Engagement reflects learners' active participation in learning activities. Autonomy refers to learners' capacity to regulate and manage their own learning processes. Meaningful learning emphasizes deep understanding, contextualized language use, and long-term knowledge construction. The framework assumes that these outcomes emerge from the interaction of learner characteristics, AI functionalities, instructional materials, and pedagogical strategies.





Adapted and developed from Materials Development Theory, Personalized Learning Theory, Sociocultural Theory, Cognitive Load Theory, Multimodality Theory, and AI in Education literature.

Figure 2. AI-Augmented Arabic Teaching Materials Framework (AI-AATM)

Overall, the AI-Augmented Arabic Teaching Materials Framework conceptualizes Arabic instructional materials as intelligent and adaptive learning ecosystems rather than static educational products. The framework highlights the central role of learner data, AI-supported personalization, pedagogically guided instructional design, and meaningful learning experiences. It therefore provides a comprehensive roadmap for researchers, curriculum designers, instructional developers, and educators seeking to transform Arabic language materials in the era of artificial intelligence. As a conceptually derived framework, the AI-AATM should be regarded as a theoretical model intended to guide future empirical investigations rather than as a validated instructional model.

DISCUSSION

Beyond Textbooks: Toward Intelligent Arabic Learning Materials

The findings of this study suggest that Arabic language teaching materials are undergoing a fundamental transformation from static instructional resources toward intelligent learning systems. For decades, textbooks have occupied a central position in Arabic language education, serving as the primary source of linguistic input, instructional guidance, and curriculum implementation. While traditional textbooks have contributed significantly to the standardization and dissemination of Arabic language instruction, their pedagogical architecture was largely developed within a pre-digital paradigm characterized by fixed content, predetermined learning sequences, and limited responsiveness to learner diversity (McGrath, 2016; Tomlinson, 2023).

The emergence of artificial intelligence fundamentally challenges conventional assumptions underlying textbook-oriented materials development. Rather than functioning as passive repositories of knowledge, AI-augmented Arabic teaching materials become intelligent pedagogical ecosystems capable of dynamically adapting instructional content, learning pathways, and feedback to learners' evolving needs (Holmes et al., 2019; Holmes & Miao, 2023; Luckin & Holmes, 2016). This transformation reflects a broader shift in educational technology toward learner-responsive environments in which instructional materials continuously evolve alongside learner development.

This transformation is particularly relevant within Arabic language education. Arabic language learners often exhibit considerable diversity in terms of linguistic backgrounds, proficiency levels, motivations, and learning objectives. Such diversity presents significant challenges for conventional textbook-based approaches that assume relatively homogeneous learner populations. AI-supported materials can address this challenge by enabling differentiated learning pathways, adaptive content delivery, and personalized feedback mechanisms.

Consequently, instructional materials become more responsive to individual learning trajectories while maintaining pedagogical coherence.

Accordingly, AI should be understood as a pedagogical augmentation rather than a replacement for existing instructional materials. Its primary contribution lies in enhancing the responsiveness, adaptability, and instructional effectiveness of Arabic teaching materials while preserving the central role of pedagogical design (Kasneji et al., 2023; Luckin & Holmes, 2016).

Taken together, these findings support a reconceptualization of Arabic teaching materials as intelligent instructional ecosystems characterized by adaptivity, contextual responsiveness, and learner-centered personalization. Such materials extend beyond digital textbooks by actively mediating learning processes and continuously responding to learners' changing needs.

Reconceptualizing Materials Development Theory

Perhaps the most significant theoretical contribution of this study lies in its reconceptualization of Materials Development Theory within the context of artificial intelligence. Traditional materials development scholarship has long emphasized principles such as learner-centeredness, authenticity, impact, flexibility, and meaningful engagement (Tomlinson, 2023). These principles have shaped decades of language materials research and continue to provide valuable guidance for instructional design. However, the emergence of AI-enabled learning environments introduces new possibilities that challenge some of the foundational assumptions underlying traditional materials development frameworks.

Conventional Materials Development Theory assumes that learner needs can be anticipated during the design process and subsequently addressed through relatively fixed instructional resources. In contrast, the proposed AI-Augmented Arabic Teaching Materials Framework conceptualizes instructional materials as continuously adaptive systems capable of responding dynamically to learner interactions through content generation, intelligent feedback, recommendation systems, and learning analytics.

This shift necessitates a theoretical expansion of Materials Development Theory. While learner-centeredness remains a foundational principle, AI introduces the possibility of continuous learner-centered adaptation. Similarly, authenticity can be enhanced through AI-generated contextualized texts and communicative tasks tailored to specific learning situations. Flexibility evolves from optional adaptation to systematic personalization, while engagement becomes increasingly mediated through interactive and responsive learning environments.

Accordingly, Materials Development Theory evolves from emphasizing pre-designed instructional resources toward supporting continuous pedagogical adaptation throughout the learning process. This reconceptualization also aligns with Sociocultural Theory, which emphasizes the mediational role of tools in learning processes (Lantolf et al., 2020). Traditionally, language learning materials functioned as mediational artifacts that supported interaction between learners and language. AI-enhanced materials extend this mediational role by actively participating in instructional processes through feedback, adaptation, and personalized support. Consequently, instructional materials acquire new forms of agency within learning environments.

Furthermore, the framework proposed in this study integrates Cognitive Load Theory into materials development discourse. Traditional materials often struggle to balance complexity and accessibility for diverse learner populations. AI-supported adaptation enables instructional materials to regulate cognitive demands according to learners' current capacities, thereby

supporting more efficient knowledge construction (Sweller et al., 2019). This capability introduces a new dimension of responsiveness that has been largely absent from traditional materials development theory.

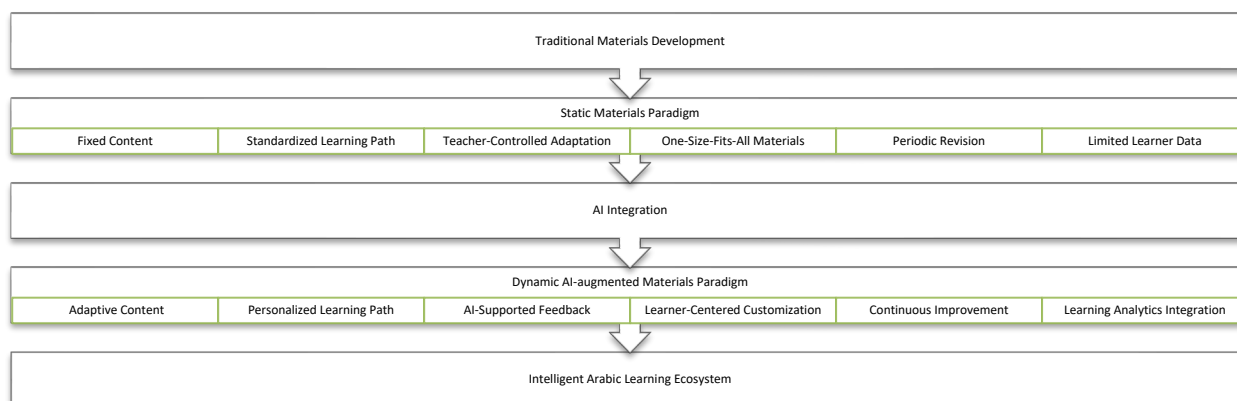


Figure 2. Theoretical Transition from Static Materials Development to Dynamic AI-Augmented Materials Development

The reconceptualization proposed here does not reject existing materials development principles. Rather, it extends and reinterprets them within contemporary technological contexts. Learner-centeredness, authenticity, flexibility, and engagement remain central objectives, but they are operationalized through adaptive and intelligent systems capable of responding continuously to learners' evolving needs. Consequently, Materials Development Theory enters a new phase in which instructional materials are understood as dynamic, data-informed, and AI-supported learning ecosystems.

The Role of AI in Personalized Arabic Learning

The findings also contribute to ongoing discussions regarding the role of artificial intelligence in personalized language learning. Personalization has become one of the most influential concepts in contemporary educational discourse, reflecting a growing recognition that learners differ substantially in terms of their backgrounds, abilities, motivations, and learning preferences (Pane et al., 2017). Within Arabic language education, such diversity is particularly evident due to the wide range of cultural, linguistic, and educational contexts represented by learners.

The AI functionalities identified within the proposed framework provide mechanisms through which personalization can be operationalized in Arabic language learning environments. Content generation enables the production of learning materials aligned with learners' proficiency levels and instructional goals (Al-Nāqah, 1985; Rosyad, Ulin, et al., 2026; Thuaimah, 2004). Recommendation systems facilitate individualized learning pathways by directing learners toward activities appropriate to their needs. Intelligent feedback offers immediate and context-sensitive support, while learning analytics provide insights into learner progress and performance patterns.

These capabilities resonate strongly with Personalized Learning Theory, which emphasizes the alignment of instructional experiences with individual learner characteristics. However, the findings suggest that personalization should not be understood merely as customization of content. Rather, effective personalization involves a broader process of adapting instructional experiences, learning pathways, feedback mechanisms, and pedagogical support structures.

Importantly, the study also highlights the social dimensions of personalized learning. Critics have occasionally argued that AI-driven personalization may encourage excessive individualization and reduce opportunities for social interaction. However, the principles identified in this study suggest an alternative perspective. Human-AI collaborative learning emphasizes the complementary relationship between technological support and human interaction. AI can personalize learning experiences while simultaneously creating opportunities for meaningful communication, collaboration, and teacher mediation.

Within Arabic language learning, this balance is particularly important because communicative competence depends heavily upon interaction, negotiation of meaning, and sociocultural engagement. Personalized learning should therefore enhance rather than replace these dimensions. AI serves as a facilitator that supports learners' participation in communicative activities rather than functioning as an isolated instructional agent.

Overall, the present findings reinforce the view that AI functions most effectively as a pedagogically guided enabler of personalized Arabic learning rather than as an autonomous instructional agent (Holmes et al., 2019; Holmes & Miao, 2023; Kasneci et al., 2023).

Proposed Paradigm Shift in Arabic Materials Development

Taken together, the findings point toward a broader paradigm shift in Arabic materials development. Historically, the field has been dominated by product-oriented approaches in which instructional materials are viewed primarily as educational artifacts to be designed, published, and implemented. The AI-Augmented Arabic Teaching Materials Framework suggests an alternative paradigm characterized by continuous adaptation, personalization, and interaction.

This paradigm shift can be understood as a movement across three conceptual dimensions. First, there is a shift from standardization toward personalization. Traditional materials prioritize consistency across learners, whereas AI-enhanced materials recognize and accommodate learner diversity. Second, there is a shift from static content delivery toward adaptive learning experiences. Instructional materials no longer function solely as repositories of information but as systems capable of responding dynamically to learner needs. Third, there is a shift from technology integration toward intelligent pedagogical orchestration, where AI functions are embedded within coherent instructional designs rather than added as supplementary technological features.

These transitions require closer collaboration among language educators, curriculum developers, instructional designers, and AI specialists to ensure that technological innovation remains aligned with pedagogical objectives (Berthelsen & Tannert, 2020; Li, 2020; Lyu et al., 2026; Shohel & Sall, 2026).

The proposed paradigm also contributes to broader debates within educational technology research concerning the relationship between technological innovation and pedagogical transformation. Rather than viewing technology as an external enhancement to existing practices, the framework suggests that AI may fundamentally reshape the nature of instructional materials themselves. In this sense, AI represents not merely a technological innovation but a catalyst for theoretical and pedagogical change (Espinoza, 2025). Collectively, these findings position AI-augmented Arabic teaching materials as intelligent learning ecosystems capable of supporting sustainable pedagogical innovation.

Table 3. Comparative Characteristics of Traditional and AI-Augmented Arabic Teaching Materials

Dimension	Traditional Arabic Teaching Materials	AI-Augmented Arabic Teaching Materials
Content Structure	Fixed and predetermined	Dynamic and adaptive
Learning Pathway	Uniform for all learners	Personalized according to learner profile
Feedback Mechanism	Teacher-dependent and delayed	Immediate and AI-supported
Materials Revision	Periodic updates	Continuous adaptation
Learner Support	Generalized support	Individualized scaffolding
Authentic Language Exposure	Limited and curated	Real-time and context-sensitive
Assessment Function	Summative-oriented	Continuous and formative
Role of Technology	Supplementary tool	Integral learning component
Role of Teacher	Primary knowledge provider	Learning facilitator and orchestrator
Data Utilization	Minimal	Learning analytics driven
Pedagogical Orientation	Content-centered	Learner-centered and responsive
Learning Environment	Static instructional setting	Intelligent learning ecosystem

Table 3 synthesizes the principal distinctions between traditional and AI-augmented Arabic teaching materials. Rather than merely introducing digital technologies, the proposed framework reflects a broader pedagogical transformation toward adaptive, learner-centered, and data-informed instructional ecosystems.

Theoretical and Practical Implications

Theoretically, this study contributes to the literature by extending Materials Development Theory into AI-mediated learning environments. The proposed framework integrates perspectives from Materials Development Theory, Personalized Learning Theory, Sociocultural Theory, Cognitive Load Theory, Multimodality Theory, and AI in Education, thereby providing a multidimensional conceptual foundation for future research. The identification of eight design principles further contributes to theory building by specifying the pedagogical characteristics that distinguish AI-augmented instructional materials from conventional resources.

Beyond its theoretical contribution, the AI-Augmented Arabic Teaching Materials Framework provides practical guidance for Arabic language teachers and curriculum developers. Rather than employing artificial intelligence merely as a tool for generating instructional content, educators are encouraged to align AI functionalities with communicative language teaching objectives, learner profiles, formative assessment strategies, and scaffolding practices. Curriculum developers should redesign Arabic learning materials as adaptive learning ecosystems in which AI supports differentiated instruction, authentic language exposure, and continuous feedback while preserving pedagogical coherence. In this way, AI functions as a pedagogical partner that enhances instructional decision-making rather than replacing teacher expertise.

At the institutional level, the proposed framework highlights the need for strategic readiness to implement AI-supported Arabic language education. Universities should invest not only in AI technologies but also in faculty professional development, ethical governance, digital infrastructure, and curriculum innovation to ensure responsible AI integration. Educational policymakers may also employ the framework as a conceptual reference for developing quality standards, institutional guidelines, and evaluation frameworks governing AI-enhanced Arabic instructional materials. Such initiatives can facilitate sustainable AI adoption while maintaining educational quality, learner protection, and equitable access across higher education contexts.

CONCLUSIONS

This study sought to address the growing need for a theoretically grounded approach to developing AI-enhanced Arabic teaching materials in higher education. Through a systematic conceptual review and thematic synthesis of the literature, eight interrelated design principles

were identified as key characteristics of effective AI-augmented Arabic teaching materials: pedagogically guided AI integration, learner-centered personalization, adaptive content sequencing, authentic Arabic language exposure, AI-supported scaffolding, multimodal learning design, ethical and responsible AI use, and human-AI collaborative learning. Collectively, these principles provide a coherent pedagogical foundation for integrating artificial intelligence into Arabic language materials development. Building upon these principles, the study proposed the AI-Augmented Arabic Teaching Materials Framework (AI-AATM), a five-layer conceptual model comprising the Learner Layer, AI Layer, Materials Layer, Pedagogical Layer, and Learning Experience Layer. The framework advances Materials Development Theory by repositioning Arabic instructional materials as intelligent, adaptive, and learner-responsive ecosystems capable of continuously supporting personalized language learning in AI-enhanced educational environments.

Beyond its theoretical contribution, the proposed AI-Augmented Arabic Teaching Materials Framework also offers practical guidance for Arabic language education. For Arabic language teachers, the framework provides a pedagogically grounded reference for integrating AI into instructional materials while maintaining communicative learning objectives, learner-centered instruction, and meaningful classroom interaction. For curriculum developers, the identified design principles may serve as a foundation for redesigning Arabic learning materials into adaptive, personalized, and AI-supported learning ecosystems. By translating theoretical insights into instructional practice, the framework is expected to facilitate more responsive, engaging, and sustainable Arabic language learning in higher education.

Despite its contributions, this study has several limitations. First, the proposed framework is conceptual in nature and has not yet been empirically validated in real instructional settings. Second, the analysis focuses primarily on higher education contexts, which may limit its applicability to other educational levels. Future research should therefore validate the AI-AATM Framework through empirical investigations, including Structural Equation Modeling (SEM) studies, experimental and quasi-experimental research designs, and cross-cultural comparative studies. Such efforts would strengthen the explanatory power, generalizability, and practical applicability of the framework across diverse Arabic language learning contexts.

ACKNOWLEDGEMENTS

The author would like to express sincere gratitude to the Arabic Language Education Study Program, Faculty of Tarbiyah and Education, UIN Sunan Kalijaga Yogyakarta, for providing an academic environment that supports scholarly inquiry and intellectual development. Appreciation is also extended to colleagues and fellow researchers in the fields of Arabic language education, instructional materials development, and educational technology whose discussions and insights have contributed to the refinement of the ideas presented in this article. Although this study did not receive specific external funding, it benefited substantially from ongoing academic engagement and research activities within the broader scholarly community of Arabic language education and artificial intelligence in learning. The author also acknowledges the growing international scholarship on artificial intelligence in language education, which provided important inspiration for the development of the AI-Augmented Arabic Teaching Materials Framework proposed in this study.

BIBLIOGRAPHY

- Al-Nāqah, M. K. (1985). *Ta'lim al-Lughah al-'Arabiyyah li al-Nāṭiqīn bi Ghayrihā: Asāsuhu wa Asālibuhu*. Jāmi'at Umm al-Qurā.
- Alam, A. (2025). Creating Safe Spaces for Language Acquisition: Reducing Anxiety and Fear Through Targeted Materials Design. In *Exploring the Psychology of Language Materials Development* (pp. 37–80). <https://doi.org/10.4018/979-8-3373-2995-6.ch002>
- Alnassan, A. (2017). L'enseignement de l'arabe L2 entre l'héritage et la nouveauté en didactique des langues vivantes. *Bellaterra Journal of Teaching and Learning Language and Literature*, 10(1), 20–41. <https://doi.org/10.5565/rev/jtl3.665>
- Arkan, Z. (2026). Evaluation of listening activities in arabic language teaching textbooks used in Turkey in light of the CEFR criteria. *Asian-Pacific Journal of Second and Foreign Language Education*, 11(1). <https://doi.org/10.1186/s40862-025-00366-5>
- Bahhari, A., & Willoughby, L. (2026). When heritage meets religion: Parents' perspectives on Arabic language education in Australian Islamic schools. *Australian Journal of Linguistics*, 46(1), 117–137. <https://doi.org/10.1080/07268602.2025.2596103>
- Berthelsen, U. D., & Tannert, M. (2020). Utilizing the affordances of digital learning materials. *L1 Educational Studies in Language and Literature*, 20(20), 1–23. <https://doi.org/10.17239/L1ESLL-2020.20.02.03>
- Braun, V., & Clarke, V. (2021). *Thematic Analysis: A Practical Guide*. SAGE publications Ltd. <https://doi.org/10.1177/1035719X211058251>
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: the state of the field. *International Journal of Educational Technology in Higher Education*, 20(1), 22. <https://doi.org/10.1186/s41239-023-00392-8>
- Espinoza, M. (2025). AI and the future of STEM education: Transforming pedagogy, curriculum, and workforce readiness. In *AI, Personalization, Equity, and the Future of Learning* (pp. 237–264). <https://doi.org/10.4018/979-8-3373-5097-4.ch008>
- Fauzan, A. R. bin I. (2010). *Idha'at li Muallim Lughah Al-Arabiyyah li Ghair Al-Natiqin Biha*. Maktabah Lisanil Arab.
- Grewal, S., Manuel, M., & Veettil, R. P. (2024). Principles and Procedures of Material Development in the Evolving ELT Scenario. *Salud, Ciencia y Tecnologia - Serie de Conferencias*, 3. <https://doi.org/10.56294/sctconf2024656>
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Holmes, W., & Miao, F. (2023). *Guidance for generative AI in education and research*. Unesco Publishing.
- Jaakkola, E. (2020). Designing conceptual articles: four approaches. *AMS Review*, 10(1), 18–26. <https://doi.org/10.1007/s13162-020-00161-0>
- Kamal, H. (2025). Teaching Arabic Today: Challenges, Strategies, and Opportunities in Islamic

- Higher Education. *International Journal of Learning, Teaching and Educational Research*, 24(10), 644–659. <https://doi.org/10.26803/ijlter.24.10.31>
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/https://doi.org/10.1016/j.lindif.2023.102274>
- Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for language teaching and learning. *Relc Journal*, 54(2), 537–550. <https://doi.org/10.1177/00336882231162868>
- Lantolf, J. P., Poehner, M. E., & Thorne, S. L. (2020). Sociocultural theory and L2 development. In *Theories in second language acquisition* (pp. 223–247). Routledge.
- Li, Y. (2020). Language–content partnership in higher education: development and opportunities. *Higher Education Research and Development*, 39(3), 500–514. <https://doi.org/10.1080/07294360.2019.1685947>
- Luckin, R., & Holmes, W. (2016). *Intelligence unleashed: An argument for AI in education*.
- Lyu, J., Tang, Y., & Ren, H. (2026). An AI-Enhanced Design Thinking Framework for Knowledge Creation and Transfer in Digital Media Education. *International Journal of Knowledge Management*, 22(1). <https://doi.org/10.4018/IJKM.400905>
- Mayer, R. E. (2002). Multimedia Learning. In *Psychology of Learning and Motivation*. Academic Press, 41, 85–139.
- McGrath, I. (2016). *Materials evaluation and design for language teaching* (2nd ed.). Edinburgh university press.
- Mishan, F. (2015). *Materials development for TESOL*. Edinburgh University Press.
- Moser, J. (2021). Evaluating Arabic textbooks: A corpus-based lexical frequency study. *International Journal of Applied Linguistics (United Kingdom)*, 31(2), 248–263. <https://doi.org/10.1111/ijal.12321>
- Pane, J. F., Steiner, E. D., Baird, M. D., Hamilton, L. S., & Pane, J. D. (2017). *Informing progress: Insights on Personalized Learning Implementation and Effects*.
- Qpilat, N., & Alhosani, H. (2026). Bridging the Divide: Teacher Professional Development for Linguistic and Pedagogical Excellence in Arabic as a Foreign Language. In *New Perspectives in Science Education - International Conference* (Vol. 2026, Issue 15).
- Reyes-Torres, A., Brisk, M. E., & Lacorte, M. (2025). *Multiliteracies, Multimodality, and Learning by Design in Second Language Learning and Teacher Education* (1st ed.). Routledge. <https://doi.org/10.4324/9781032620497>
- Rosyad, M. S., Rosyadi, F. I., Huda, N., Paramita, N. P., & Guangli, M. (2026). From Grammar-Centered to Communicative Materials: Rethinking Arabic Language Teaching Resources in Higher Education. *Arabiyatuna: Jurnal Bahasa Arab*, 10(1), 103–122. <https://doi.org/10.29240/jba.v10i1.16227>
- Rosyad, M. S., Ulin, N. M. A., Muhammad, H., Abdur, R. M., Ahmad, N., & bin Md Din, A. G. (2026). From CEFR to AI-Assisted Learning: Contemporary Transformations in Arabic Language

Teaching for Non-Native Speakers. *ATHLA: Journal of Arabic Teaching, Linguistic and Literature*, 7(1), 37–56. <https://doi.org/10.22515/athla.v7i1.14295>

Shohel, M. M. C., & Sall, W. (2026). Students as the Co-Creators of Teaching and Learning Materials for an Undergraduate Module. In *Bridging Theory and Application Through Practitioner Research in Higher Education* (pp. 111–152). <https://doi.org/10.4018/979-8-3693-7142-8.ch005>

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339. <https://doi.org/10.1016/j.jbusres.2019.07.039>

Sweller, J., Merriënboer, J. J. G., & Paas, F. (2019). Cognitive Architecture and Instructional Design : 20 Years Later. *Educational Psychology Review*, 261–292. <https://doi.org/10.1007/s10648-019-09465-5>

Thuaimah, R. A. (2004). *al-Mahârat al-Lughawiyyah; Mustawayâtuhâ Tadrîsuhâ Şu'ûbatuhâ*. Dar al-Fikr al-Arabi.

Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, 10(1), 15. <https://doi.org/10.1186/s40561-023-00237-x>

Tomlinson, B. (2023). *Developing materials for language teaching*. Bloomsbury Publishing.

UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. UNESCO Publishing.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 39. <https://doi.org/10.1186/s41239-019-0171-0>

Zulhannan, n., Kesuma, G. C., Musyarrofah, U., & Andriansyah, Y. (2025). Enhancing Communicative Arabic Teaching: Evaluating the AI-Arabiyah Baina Yadaik Model. *Journal of Educational and Social Research*, 15(3), 318–335. <https://doi.org/10.36941/jesr-2025-0100>