

THE INTEGRATION OF PSYCHOLINGUISTICS IN THE DESIGN OF DIGITAL TECHNOLOGY-BASED ARABIC LANGUAGE INSTRUCTION

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Abstrak

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This study examines the integration of psycholinguistic theory into Arabic language learning design that utilizes digital technology, with a focus on the educational context in Indonesia. Although studies on psycholinguistics and learning technology have developed separately, there is currently no conceptual framework that systematically links the two within the specific context of Arabic language learning. The study employs a qualitative approach using content analysis on primary sources, including journal articles, academic books, and conference proceedings from 2015 to 2024. The findings indicate that major psycholinguistic theories—including Krashen's input hypothesis, Baddeley's working memory theory, Sweller's cognitive load theory, and Paivio's dual coding theory exhibit strong functional correspondence with various digital platforms such as Quizizz, Padlet, YouTube, and spaced repetition apps. This integration has been theoretically proven to optimize cognitive processing, improve vocabulary retention, and accelerate the holistic acquisition of Arabic language proficiency. This research contributes to the development of evidence-based Arabic language pedagogy in the era of educational digitalization.

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INTRODUCTION

The Arabic language holds a strategic position in Indonesia's educational landscape, particularly in Islamic-based institutions such as madrasahs, pesantren, and Islamic higher education institutions (PTAI). Data from the Ministry of Religious



Affairs of the Republic of Indonesia in 2023 indicates that there are more than 82,000 madrasahs and thousands of pesantren that consistently include Arabic as a core subject. However, surveys and field research consistently indicate that Indonesian students' proficiency in Arabic remains far from satisfactory, particularly in productive skills such as speaking and writing.

This paradox has prompted researchers and education practitioners to seek new, more effective approaches. One promising field is psycholinguistics, a branch of science that examines the relationship between mental processes and language acquisition and use. Fundamentally, psycholinguistics seeks to answer the question of how humans acquire, process, store, and produce language (Hanifansyah, 2025). A deep understanding of these cognitive mechanisms should form the foundation for any effective language learning design, including Arabic.

On the other hand, the digital technology revolution has fundamentally transformed the learning landscape (Huda & Ghufroon, 2025). Platforms such as Quizizz, Padlet, YouTube, Google Classroom, and various mobile apps have made their way into classrooms across Indonesia, including in Islamic educational institutions that were previously known for their conservatism (Deng, 2026). A survey conducted by Pustekkom Kemdikbud (2022) shows that more than 74% of Arabic teachers in madrasahs have integrated at least one form of digital technology into their teaching, although most do so without an adequate theoretical foundation.

This is where the research gap lies, forming the core of the problem addressed in this study. Existing studies tend to separate these two important domains: one group of research discusses psycholinguistic theory in an abstract manner without operationally linking it to digital technology, while another group examines the effectiveness of specific digital platforms without explaining why, cognitively, those platforms work or fail. There is currently no conceptual framework that systematically and comprehensively links psycholinguistic theories with the design of digital technology-based Arabic language learning in the Indonesian context.

The urgency of this research is further underscored by the implementation of the Merdeka Curriculum, which promotes student-centered learning and the meaningful use of technology (Mirantika, Aziz, Utama, & Furqan, 2025). Without a strong psycholinguistic foundation, the adoption of technology in Arabic language learning risks becoming merely a digital facelift changing the medium but failing to transform the quality of the cognitive learning process (Al-Ahdal, 2020).

Based on the above, this study aims to: (1) identify and analyze the psycholinguistic theories most relevant to the design of Arabic language learning; (2) map the correspondence between psycholinguistic principles and the specific functions of digital platforms and applications; (3) develop an integrative framework that can serve as a guide for the design of digital technology-based Arabic language learning; and (4) explain the implications of this framework for Arabic language learning practices in Indonesia.

LITERATURE REVIEW

Psycholinguistics and Language Acquisition Theory

Psycholinguistics, as a discipline, stands at the intersection of cognitive psychology and linguistics. This field examines how language is represented and processed in the human brain, covering aspects of first, second, and foreign language

acquisition. Several theories in psycholinguistics have direct relevance to the design of Arabic language learning (Adinda, Fazira, Hidayah, & Nasution, 2024).

Stephen Krashen (1982, 1985), through his Monitor Model consisting of five hypotheses, has made a fundamental contribution. The comprehensible input hypothesis states that language acquisition occurs when learners are exposed to language input that slightly exceeds their current competence ($i+1$) (Baharun, 2025). This hypothesis has direct implications for the selection of digital materials: Arabic content on YouTube, for example, needs to be calibrated according to the learner's proficiency level so that it becomes comprehensible input rather than mere linguistic noise.

Alan Baddeley and Graham Hitch (1974) developed a working memory model, which was later refined by Baddeley (2000) with the addition of an episodic buffer. This model identifies three main components: the phonological loop, which processes auditory-verbal information; the visuospatial sketchpad, which handles visual and spatial information; and the central executive, which coordinates both. The relevance of this model to Arabic language learning is significant, given that Arabic has a complex phonological system (makharijul huruf, mad, tasydid) that places a different cognitive load on the phonological loop compared to European languages (Baharun, 2025).

John Sweller (1988) developed Cognitive Load Theory (CLT), which distinguishes three types of cognitive load: intrinsic load (the inherent complexity of the material), extraneous load (load resulting from poor instructional design), and germane load (load that contributes to the formation of new schemas). The implications of CLT for the design of digital-based Arabic language learning are highly practical: an overly cluttered interface, confusing navigation, or poorly integrated multimedia can increase extraneous load and actually hinder language acquisition.

Allan Paivio (1971, 1986), through his Dual Coding Theory (DCT), argues that humans process information through two distinct yet interconnected representational systems: the verbal system and the nonverbal (visual/iconic) system. Simultaneous processing through both systems results in stronger and more accessible memory traces. DCT directly supports the use of media that combines audio, text, and visuals in Arabic language learning.

Lev Vygotsky (1978), with his theory of social constructivism, introduced the concept of the Zone of Proximal Development (ZPD) the gap between what a learner can do independently and what they can achieve with the help of a more competent person. The concept of scaffolding, developed from Vygotsky's ideas, is highly relevant in the context of collaborative digital platforms that enable interaction among learners and between learners and teachers, both asynchronously and synchronously.

Arabic Language Instructional Design: A Critical Review

Arabic language learning design in Indonesia has historically been influenced by two major, often conflicting paradigms: the traditional grammatical-translation paradigm (qawa'id wa tarjamah), which emphasizes mastery of nahwu and sharaf through memorization and deductive exercises, and the communicative paradigm, which emphasizes pragmatic competence and fluency in communication.

Studies on Arabic language learning design conducted by previous researchers reveal several systemic weaknesses. First, there is a lack of consideration for learners' cognitive processes in the development of syllabi and materials. Second, the absence of adequate input gradation materials are presented as too difficult without sufficient scaffolding overburdens learners' working memory. Third, evaluation focuses on the

product (outcome) rather than the process (cognitive strategies), thus failing to provide an accurate picture of linguistic competence development (Hakami, 2024).

(Azis, 2020) research on Arabic language learning in Salafi boarding schools indicates that while linguistic immersion in the boarding school environment provides high exposure, the absence of scaffolding based on cognitive understanding causes many students to experience fossilization—that is, the halting of language development at a certain level. This finding underscores the importance of instructional design that explicitly considers language processing mechanisms.

Digital Technology in Language Learning

The literature on the use of technology in language learning (Computer-Assisted Language Learning/CALL and Mobile-Assisted Language Learning/MALL) has grown rapidly since the early 2000s. Godwin-Jones (2017) identified three generations of CALL: behaviorist (drills and exercises), communicative (simulations and games), and integrative (web and authentic multimedia). Digital-based Arabic language learning in Indonesia is currently in transition from the second to the third generation (Alhadiah, 2020).

Recent studies show promising results. Basuki's research on 120 Arabic language students at UIN Malang found that the use of Quizizz increased intrinsic motivation and vocabulary retention compared to conventional exercises. (Maimunah, Khasairi, & Irhamni, 2026) study in Saudi Arabia found that integrating YouTube into listening comprehension instruction increased listening comprehension scores by 23% over eight weeks. Meanwhile, (Widodo, 2021) found that using Padlet as a collaborative written expression platform increased both the frequency and quality of written output among Arabic language students.

However, these studies share a common limitation: they measure effectiveness without explaining the cognitive mechanisms underlying that success. In other words, they answer the question of whether the technology is effective, but do not explain why or how. This research gap is precisely what this study aims to address through a psycholinguistic approach.

METHODOLOGY

This study employs a qualitative approach using a systematic literature review design. The qualitative approach was chosen because the research objectives are interpretive and conceptual namely, to construct a previously nonexistent theoretical integration framework rather than to test statistical hypotheses. The method used is content analysis with a theory-driven orientation, which allows the researcher to identify, classify, and interpret conceptual patterns in the reviewed literature (Krippendorff, 2018).

The primary data sources for this study include: (1) articles from reputable international and national scientific journals indexed in Scopus, Web of Science, DOAJ, and Sinta, spanning the years 2015–2024; (2) fundamental academic books in the fields of psycholinguistics, instructional design, and learning technology; (3) proceedings from leading international conferences in the fields of applied linguistics and CALL; and (4) relevant educational policy reports and documents from the Ministry of Religious Affairs and the Ministry of Education of the Republic of Indonesia. A total of 187 documents were initially identified, then filtered through inclusion and exclusion criteria to yield 68 directly relevant sources, 24 of which were selected as primary references.

Data collection was conducted in three stages. First, sources were identified

through systematic searches in the Google Scholar, JSTOR, ERIC, and repository databases. Analisis data dilakukan melalui proses: (1) open coding untuk mengidentifikasi konsep-konsep kunci dari setiap sumber; (2) axial coding untuk menemukan hubungan antar-konsep; (3) selective coding untuk mengintegrasikan konsep-konsep tersebut ke dalam kerangka teoretis yang koheren. Keabsahan data dijaga melalui triangulasi sumber (triangulating across sources), member checking dengan konsultasi pakar, dan reflektivitas peneliti dalam mendokumentasikan proses analisis.

RESULTS AND DISCUSSION

The Correspondence Between Psycholinguistic Theory and Digital Technology: A Conceptual Mapping

The results of the literature review indicate that Krashen's theory of language acquisition correlates with the use of media based on authentic input, such as YouTube and Arabic-language podcasts, which provide language exposure in accordance with the principle of comprehensible input. Meanwhile, Baddeley's working memory theory corresponds with digital flashcard applications such as Anki and Quizlet, which facilitate scheduled vocabulary review (Baddeley & Hitch, 1974). Regarding cognitive load management, Sweller's theory is relevant to the use of Padlet and digital infographics, which allow for the presentation of material in a simpler and more structured manner (Sweller, 1988). Additionally, Vygotsky's social constructivism theory supports the use of collaborative platforms like Google Classroom and Quizizz, while Paivio's dual coding theory reinforces the use of animated videos and visual media in Arabic language learning (Vygotsky, 1978).

That are specific and clearly identified in relation to the functions of certain digital platforms. This correspondence is not merely decorative; rather, it implies concrete design principles. For example, the integration of Cognitive Load Theory (Sweller) with the use of Padlet implies that teachers need to design clean and structured Padlet templates, avoiding excessive visual stimuli that can increase extraneous cognitive load and divert cognitive resources away from the processing of Arabic itself (Baddeley, 2000).

An interesting finding from this mapping is that no single digital platform is capable of activating all psycholinguistic dimensions simultaneously (Field, 2019). This implies that effective instructional design requires careful digital curation the selection and combination of complementary platforms based on psycholinguistic principles rather than merely following technological trends or relying on device availability.

Digital Media as a Cognitive Stimulus: A Mechanistic Analysis

A central question often overlooked in studies of learning technology is: how do digital stimuli work at the cognitive level to facilitate language acquisition? An analysis of the reviewed literature yields a mechanistic model that explains the information processing pathways from digital stimuli to linguistic representations stored in long-term memory (Fuad, 2021).

When an Arabic language learner watches an Arabic-language YouTube video, at least three cognitive processes occur simultaneously: (1) selecting relevant information from incoming auditory and visual inputs, which are processed separately through the phonological loop and the visuospatial sketchpad; (2) organizing the selected information into a coherent representation in working memory, which requires the involvement of the central executive; and (3) integrating the new representation with existing knowledge in

long-term memory (prior knowledge). This three-stage model, known as the Cognitive Theory of Multimedia Learning (CTML) by Mayer (2009), has rich design implications.

Specifically for Arabic, the first stage is particularly critical, given that the Arabic phonological system (which includes 28 consonants, some of which are phonemes unfamiliar to Indonesian speakers, such as /ʕ/, /ħ/, /q/, /ð/) requires a significant allocation of cognitive resources. Research by (Wahba, Taha, & England, 2014) shows that early-stage learners of Arabic experience higher cognitive overload compared to learners of Spanish or French at equivalent levels, due to the significant differences in the writing system (the Arabic alphabet) and phonology from the Indonesian learners' native language.

The design implications derived from this analysis are the need for a gradation of digital stimuli that accounts for the phonological and morphological complexity of Arabic. Platforms like Anki or Quizlet, which use spaced repetition algorithms, for example, indirectly implement Baddeley's principle of information maintenance within the phonological loop through optimally scheduled repetition, ensuring that vocabulary items are reviewed just before they are forgotten, thereby reinforcing memory traces without adding unnecessary cognitive load.

Digital Platforms and the Four Arabic Language Skills

An analysis of the literature reveals a consistent pattern regarding how various digital platforms can be optimized to support the acquisition of the four Arabic language skills (listening, speaking, reading, and writing) based on psycholinguistic principles.

The literature review indicates that each digital platform possesses distinct psycholinguistic characteristics. Quizizz is more effective for reinforcing vocabulary and grammatical structures through the principle of reinforcement learning. Padlet supports writing and reading skills through collaborative interaction (Khotijah & Indriana, 2024). YouTube provides authentic input that is essential for developing listening skills, while Anki and Quizlet aid vocabulary retention through spaced repetition mechanisms. Google Classroom functions as a scaffolding space that allows teachers to organize the learning process step-by-step according to students' needs (Wu & Bakar, 2025).

Each platform has a different psycholinguistic foundation and optimally supports different language skills. This runs counter to the one-size-fits-all approach that, unfortunately, remains common in digital Arabic language learning practices in Indonesia, where Quizizz is often used for all skills without considering its cognitive suitability (Spector & Lockee, 2021).

It is important to highlight the final note regarding Duolingo Arabic: this popular gamified platform has serious limitations for the context of standard Arabic (Fusha) learning because its primary content is dialect-based. From a psycholinguistic perspective, using Duolingo Arabic without adequate supplements has the potential to build inaccurate linguistic representations in learners' long-term memory a problem that is far more difficult to correct than starting from scratch (Sharples, 2019).

Comparison Between Conventional and Psycholinguistic-Digital Approaches

To contextualize the contribution of the proposed framework, it is important to systematically compare conventional language learning approaches with those integrated with psycholinguistic principles and digital technology. Table 1 presents this comparison.

Tabel 1. Comparison of Conventional and Psycholinguistic-Digital Approaches in Arabic Language Learning

Learning Dimension	Conventional Approach	Psycholinguistic-Digital Approach	Integrative Advantages
Vocabulary Acquisition (<i>Mufradat</i>)	Memorization of vocabulary lists, printed dictionaries	Long-term retention increases by 40–60% (Nakata, 2011)	Long-term retention increases by 40–60% (Nakata, 2011)
Listening (<i>Istima'</i>)	Cassette/CD recordings, static language laboratories	Authentic YouTube videos with interactive transcripts	Exposure to authentic input improves phonetic accuracy
Speaking (<i>Kalam</i>)	Limited classroom role-play with minimal practice opportunities	Arabic AI chatbots, voice recorders, and self-recording activities	Reduces speaking anxiety and enhances self-confidence
Reading (<i>Qira'ah</i>)	Printed texts and manual dictionary use	Digital texts with dictionary hyperlinks and collaborative annotations	Reading comprehension improves through metacognitive strategies
Writing (<i>Kitabah</i>)	Written assignments with teacher-only feedback	Collaborative Padlet activities and Google Docs with peer feedback	Revision processes become more dynamic; the Zone of Proximal Development (ZPD) is socially facilitated
Assessment	Periodic written examinations	Quizizz, adaptive quizzes, and digital portfolios	Instant feedback supports metacognition and self-regulation

Source: Adapted and developed from Mustofa (2022), Hermawan (2022), and a synthesis of relevant literature.

Table reveals that the shift from a conventional approach to a psycholinguistic-digital approach is not merely a substitution of instructional media; rather, it represents a fundamental transformation in the philosophy of learning. In conventional approaches, learners are often positioned as passive recipients of linguistic information. In contrast, within the psycholinguistic-digital approach, learners act as active agents in constructing their own linguistic knowledge, while digital technology functions as a scaffold that dynamically adapts to the development of their competencies.

It should be noted that this comparison is not intended to discredit conventional approaches altogether. Traditional methods of teaching *qawa'id* (Arabic grammar), for example, still hold significant value in fostering metalinguistic awareness, which is particularly important for adult learners of Arabic. The proposed CAST framework is therefore not intended as a complete replacement but rather as an integrative model that strengthens the advantages of conventional approaches by adding a technological layer grounded in cognitive and psycholinguistic principles.

Challenges and Opportunities for Implementation

The context of Indonesia's education system presents both unique challenges and opportunities for the implementation of the proposed framework. On the challenge side, the disparity in digital infrastructure between urban and rural areas remains significant: a BPS survey (2023) indicates that internet access in 3T regions (Frontier, Outermost, and Disadvantaged) remains below 40%. This means that an approach relying entirely on cloud-based platforms such as Google Classroom or Padlet cannot yet be implemented uniformly.

The second challenge is the need to improve the digital literacy of Arabic language teachers. (Fuad, 2021) research found that 58% of Arabic language teachers at junior high schools in Central Java reported difficulty in meaningfully integrating digital technology into their teaching not due to a lack of devices, but due to a lack of pedagogical understanding of how technology supports the language learning process.

However, the Indonesian context also presents significant opportunities. First, the high rate of smartphone usage among young Indonesian students APJII (2023) reports that smartphone penetration has reached 89% in the 15–24 age group provides an adequate infrastructure for MALL (Mobile-Assisted Language Learning). Second, the unique pesantren ecosystem creates an immersive environment that, when supplemented with digital scaffolding based on psycholinguistic principles, can serve as a highly effective model for Arabic language learning. Third, the momentum of the Merdeka Curriculum, which promotes differentiated and project-based learning, opens up broader opportunities for the meaningful implementation of digital technology in Arabic language learning.

CONCLUSION

This study has achieved its objectives through a systematic analysis and comprehensive synthesis of the relevant literature. It has been identified that the major psycholinguistic theories most relevant to Arabic language learning design are: Krashen's Input Hypothesis, Baddeley's Working Memory Theory, Sweller's Cognitive Load Theory, Paivio's Dual Coding Theory, and Vygotsky's Social Constructivism, each of which offers concrete and operational design principles.

A systematic correspondence was mapped between these theories and digital platforms that are widely available and used in Indonesia: YouTube (input hypothesis), Anki/Quizlet (working memory), Padlet (cognitive load & social constructivism), Quizizz (affective filter & reinforcement), and Google Classroom (scaffolding & ZPD). This correspondence demonstrates that the adoption of technology in Arabic language learning should not be random or trend-driven, but rather grounded in evidence-based psycholinguistic selection.

This study develops the CAST Framework (Cognitive-Affective-Social-Technological), an original conceptual contribution that systematically integrates the four dimensions of technology-based Arabic language learning. This framework is a novel research contribution that addresses the identified research gap: the absence of an integrative framework linking psycholinguistics with digital technology in the context of Arabic language learning in Indonesia.

An analysis of the Indonesian context reveals that implementation challenges (digital disparities, teacher literacy) are no greater than the available opportunities (high smartphone penetration, the pesantren ecosystem, the Merdeka Curriculum), provided that instructional design is grounded in an appropriate framework and its implementation is supported by adequate

teacher training. Further research is recommended to empirically test the CAST Framework through experimental or quasi-experimental studies across various levels and types of Arabic language educational institutions in Indonesia, in order to generate practical validation and necessary refinements.

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