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Breaking the Digital Breach: Preserving Tamil Heritage Through Structured, AI-Enhanced Literacy

*By Elizabeth D. Diaz**

This paper introduces miABCTamil, a design-based educational application developed to address the structural gap — here termed the digital breach — between the interaction architectures of contemporary digital platforms and the cognitive demands required for deep heritage language literacy. Defined formally, the digital breach denotes the mismatch between design environments that privilege rapid stimulus-response engagement and the sustained interpretive processing that meaningful linguistic transmission requires. For classical heritage languages such as Tamil, which carries over two millennia of uninterrupted literary tradition, this breach is acutely consequential. miABCTamil comprises ten systematically sequenced modules — Tamil Alphabet, Tamil Sounds, Colors, Math, Festivals, Write, Words, Complete, Figures, and I Can Read in Tamil — designed to build literacy from foundational phonological encoding through to integrated cultural comprehension. A dedicated Words module enables dynamic, personalized vocabulary development, while a Festivals module anchors language acquisition within the lived cultural practices of Tamil Nadu. The application is designed to integrate seamlessly with its companion platform, miabc.online, enabling educators and parents to input custom texts that are processed through a Bloom's Taxonomy-based scaffolding architecture, generating comprehension questions across multiple cognitive levels. Grounded in levels-of-processing theory (Craik and Lockhart 1972), Vygotsky's Zone of Proximal Development (1978), and heritage language acquisition research (Montrul 2016, Cummins 1979), this paper argues that cognitive depth in digital learning environments depends on intentional architectural design rather than technological affordance alone. A six-stage cognitive model — Activate, Decode, Interpret, Reflect, Repair, Integrate — is proposed as a transferable framework for heritage literacy pedagogy. The paper further introduces the concept of digital classicism: the deliberate structuring of digital environments to preserve the interpretive depth and reflective rigor of classical linguistic traditions. As a design-based research contribution (McKenney and Reeves 2019), this paper presents the theoretical and architectural rationale of miABCTamil, discusses implications for heritage language education globally, and identifies directions for future empirical validation.

Keywords: *heritage language education, Tamil literacy, digital classicism, digital breach, cognitive scaffolding, Bloom's Taxonomy, bilingual learning, AI-enhanced education*

*Professor, University of Texas at Arlighton, Texas, USA.

Introduction

The Digital Breach: A Formal Definition

The rapid proliferation of digital learning environments has transformed how young learners encounter language. Educational platforms have multiplied, and access to instructional content has expanded dramatically across demographic and geographic boundaries. Yet quantity of access does not guarantee quality of cognitive engagement. As Gee (2003) observes in his analysis of digital learning architectures, the dominant design logic of interactive media tends to privilege immediacy, reward cycles, and surface-level stimulus-response patterns over the slower, more deliberate processes that sustain deep comprehension.

In this paper, the term *digital breach* — introduced as an original theoretical construct — denotes the structural gap between the cognitive demands required for deep linguistic comprehension and the interaction patterns commonly reinforced by digital media. The breach is not a product of technology per se; it emerges from design architectures that privilege immediacy over reflection, recognition over interpretation, and engagement metrics over epistemic depth (Prensky 2001, Spolsky 2004). It is an architectural problem, and it therefore requires an architectural solution.

For heritage languages — particularly those carrying classical literary traditions — this breach is especially consequential. Languages such as Tamil do not merely encode meaning; they transmit a way of knowing, a cognitive orientation shaped by millennia of poetic, philosophical, and religious discourse. When digital platforms fail to scaffold the interpretive processes that such traditions demand, heritage language learning risks becoming superficial performance rather than genuine acquisition.

Heritage Languages in Digital Contexts

Tamil stands as one of the world's oldest continuously spoken and written languages, with a documented literary tradition extending over 2,000 years. Recognized by UNESCO (2003) as a Classical Language, Tamil has maintained its structural integrity across millennia while continuing to evolve as a living medium of governance, education, literature, and daily communication. It is spoken by over 75 million people across Tamil Nadu, Sri Lanka, Singapore, Malaysia, and diasporic communities worldwide.

Heritage language learners, particularly those in diasporic communities, commonly experience fragmented exposure to their ancestral languages. Research on heritage language acquisition (Montrul 2016, Cummins 1979) consistently demonstrates that maintaining linguistic competence requires structured, meaningful engagement rather than incidental exposure alone. As Baker (2011) argues in his foundational treatment of bilingual education, language maintenance depends not only on input quantity but on the cognitive and affective quality of that input. Similarly, Byram (1997) emphasizes that effective language education must embed cultural meaning within linguistic instruction — that language and culture are not separable domains but constitutive of one another.

This inseparability of language and culture is not merely a theoretical claim; it is borne out in the institutional practice of heritage language communities worldwide. Zoupa and Karlis (2025), in their study of the Hellenic School of Ottawa — a Heritage Language School (HLS) operated by the Greek-Canadian diaspora — found that effective HLS programs combine formal language instruction with cultural activities including festivals, history, geography, and the arts, precisely because administrators and educators recognize that ethnic identity and linguistic competence cannot be cultivated independently. Their research also identifies critical sustainability challenges facing such schools: limited resources, narrow digital integration, and difficulties sustaining community engagement across generations. These findings affirm both the urgency of the design problem that miABCTamil addresses and the institutional precedent for embedding cultural content within heritage language curricula.

As digital-native generations increasingly encounter Tamil through screens rather than community immersion, the central design question becomes: How can digital platforms be architected to support the deep cognitive engagement that heritage language transmission demands, while preserving the linguistic and cultural integrity of the tradition itself? This paper introduces miABCTamil as a principled, design-based response to that question.

Theoretical Framework

The design architecture of miABCTamil is grounded in four interconnected bodies of theory: levels-of-processing cognitive psychology, Vygotskian scaffolding, Bloom's Taxonomy of educational objectives, and heritage language acquisition research. This section develops each framework and articulates its application to the platform's design logic.

Levels of Processing

Craik and Lockhart's (1972) levels-of-processing framework proposed that memory retention is a function of depth of encoding rather than mere repetition. Shallow processing — such as graphemic recognition or surface-level matching — produces weak, transient memory traces. Semantic and interpretive processing, by contrast, produces more durable and retrievable representations. This foundational insight challenged the prevailing rehearsal-based models of memory and directed attention toward the qualitative character of cognitive engagement.

Subsequent research has refined and partially contested this framework. Baddeley (1986) demonstrated that working memory capacity and the phonological loop play crucial roles in initial encoding, complicating any simple hierarchy of processing depth. Perfetti and Hart (2002), in developing their lexical quality hypothesis, argued that reading proficiency depends on the precision and redundancy of lexical representations, suggesting that orthographic, phonological, and semantic processing must be integrated rather than sequentially staged. These

refinements do not undermine the levels-of-processing insight; rather, they enrich it by specifying the mechanisms through which depth is achieved.

Applied to digital literacy design, this framework suggests that interaction architectures which encourage elaboration, inference, and reflection will support stronger encoding than architectures that emphasize rapid response cycles. miABCTamil operationalizes this principle by embedding tasks that require semantic interpretation and reflective engagement at every stage of the learning sequence.

Scaffolding and the Zone of Proximal Development

Vygotsky (1978) introduced the Zone of Proximal Development (ZPD) as the conceptual space between a learner's current independent capability and the higher-level performance they can achieve with guided support. Effective instruction, on this account, is not instruction pitched at what a learner already knows, but rather support calibrated to the learning edge — challenging enough to extend capability, structured enough to prevent failure.

The concept of scaffolding as a pedagogical practice was operationalized by Wood et al. (1976), whose study of adult-child problem-solving interactions identified six core functions of effective tutoring: recruiting interest, reducing the degrees of freedom, maintaining direction, marking critical features, controlling frustration, and demonstrating. These functions map directly onto the design requirements of effective educational software: a platform must recruit motivation, structure complexity, maintain task orientation, highlight salient features of the target language, support productive struggle, and model fluent performance.

Digital environments can replicate many aspects of scaffolding when they activate prior knowledge, provide graduated support, offer corrective feedback, and progressively reduce assistance as competence grows (Mayer 2009, Sweller 1988). miABCTamil's six-stage learning architecture — detailed in Section 3 — reflects this scaffolded progression explicitly.

Bloom's Taxonomy and Structured Comprehension

The revised version of Bloom's Taxonomy, as reformulated by Anderson and Krathwohl (2001), organizes cognitive processes along a developmental continuum: Remember, Understand, Apply, Analyze, Evaluate, Create. Unlike the original taxonomy (Bloom 1956), which used noun categories, the revised framework employs action-verb formulations that more directly specify observable cognitive behaviors and thus better serve instructional design purposes.

The relevance of this taxonomy extends beyond traditional educational design to encompass the emerging landscape of AI-integrated learning. Bennett and Abusalem (2024), in their analysis of generative AI technologies and their implications for higher education, argue that learning outcomes must shift away from content memorization and recall — the lower registers of Bloom's hierarchy — toward the development of higher-order thinking skills such as critical analysis, evaluation, creativity, and problem solving. They observe that AI tools capable of generating surface-level responses at speed create a specific risk: that students and designers alike become satisfied with performance at precisely the level of cognitive

engagement that Craik and Lockhart (1972) identified as insufficient for durable learning. For miABCTamil, this risk is architectural as much as individual: a platform that uses AI to generate only recall-level questions would reproduce the very passive consumption architecture it is designed to disrupt. The Bloom's Taxonomy-based scaffolding of miabc.online directly addresses this concern, ensuring that AI-generated questions span the full cognitive hierarchy from Remember through Create.

In miABCTamil, comprehension questions generated through integration with miabc.online are structured to span multiple levels of this taxonomy. A learner engaging with a text about Pongal, for example, may first be asked to identify the name of the festival (Remember), then to explain its agricultural significance (Understand), then to connect it to a family ritual they know (Apply), then to compare it with another seasonal celebration (Analyze). This graduated scaffolding ensures that language encounters are not reduced to surface-level recognition but are extended through progressively more demanding cognitive operations.

The taxonomy serves not as a rigid classification instrument but as a structural guide to ensure cognitive variety and developmental progression in the learning sequence.

Heritage Language Acquisition

Heritage language research (Montrul 2016, Cummins 2000) establishes that structured literacy experiences play a critical role in maintaining proficiency and sustaining identity alignment in diasporic learners. The challenge facing heritage language education is not simply linguistic: it is simultaneously cognitive, affective, and cultural. Learners must develop phonological and orthographic competence, but they must do so within a context that makes the language feel meaningful, owned, and alive.

Cummins' (1979) linguistic interdependence hypothesis offers an important theoretical resource here: it proposes that the literacy skills and conceptual knowledge developed in one language transfer to and support acquisition in a second language, provided the learner's first language is sufficiently developed. This principle underwrites the bilingual architecture of miABCTamil, which uses English as a bridge language to Tamil acquisition rather than positioning the two languages in competition.

Byram's (1997) framework of intercultural communicative competence further informs the platform's cultural embedding strategy. For Byram, language education is inadequate if it develops linguistic accuracy without cultivating the interpretive frameworks needed to navigate cultural meaning. miABCTamil integrates cultural content — festivals, family structures, traditional arts, moral narratives — not as supplementary enrichment but as constitutive of the language-learning experience itself.

The miABCTamil Model: Design Architecture

System Overview: Ten Modules

miABCTamil comprises ten modules designed to build progressively structured Tamil-English bilingual literacy (Table 1). The modules are sequenced to move from foundational encoding systems through vocabulary development and cultural embedding to integrated comprehension and independent reading.

Table 1. *Modules of miABCTamil*

Module	Focus	Primary Skill Domain
1. Tamil Alphabet	All 12 vowels, 18 consonants, and compound letters	Phonological & orthographic encoding
2. Tamil Sounds	Syllable patterns; special Tamil phonemes (zh, l, r, n)	Phonemic awareness & articulation
3. Colors	Color vocabulary with cultural and festival significance	Semantic vocabulary
4. Math	Tamil and English numbers; traditional counting systems	Numeracy & bilingual vocabulary
5. Figures	Geometric shapes; Kolam pattern introduction	Spatial reasoning & cultural art
6. Festivals	Top Tamil Nadu festivals with foods, clothing, and customs	Cultural literacy & identity
7. Write	Letter formation; guided writing practice	Orthographic production
8. Words	Dynamic vocabulary management; custom word addition	Lexical development
9. Complete	Syllable and word completion exercises	Phonological processing
10. I Can Read in Tamil	Progressive Tamil cultural texts; AI-generated comprehension questions	Reading fluency & comprehension

The Six-Stage Cognitive Architecture

The central design innovation of miABCTamil is a six-stage learning flow — *Activate, Decode, Interpret, Reflect, Repair, Integrate* — that operationalizes the theoretical frameworks outlined in Section 2 (Table 2). Each stage serves a distinct cognitive function, and together they constitute a scaffolded progression from prior knowledge activation to consolidation and transfer.

Table 2. *Stages of miABCTamil*

Stage	Cognitive Function	Design Implementation	Theoretical Basis
1. Activate	Schema priming; background knowledge activation	Cultural image or question prompting prior knowledge of Tamil context	Vygotsky (1978), Craik & Lockhart (1972)
2. Decode	Phonological and orthographic processing	Letter-sound correspondence; syllable construction; native audio	Baddeley (1986), Perfetti & Hart (2002)
3. Interpret	Meaning construction; causal and contextual reasoning	Vocabulary in cultural context; bilingual bridging	Cummins (1979), Byram (1997)
4. Reflect	Metacognitive monitoring of comprehension	Bloom-level comprehension questions; self-assessment prompts	Anderson and Krathwohl (2001), Bennett and Abusalem (2024)
5. Repair	Strategy-based correction of misunderstanding	Targeted feedback; guided re-reading; error analysis	Wood et al. (1976), Mayer (2009)
6. Integrate	Consolidation through connection and transfer	Cross-module links; personalized vocabulary; family engagement	Montrul (2016), Baker (2011), Zoupa and Karlis (2025)

To illustrate: a lesson centered on Pongal — the Tamil harvest festival celebrated in January — begins by activating the learner's existing sensory and cultural knowledge (Stage 1). It then decodes the Tamil script of the festival's name and associated vocabulary (Stage 2). Through culturally situated sentences, the learner constructs meaning around harvest, gratitude, and community (Stage 3). Comprehension questions at the Understand and Apply levels prompt reflection on what has been encountered (Stage 4). Where misunderstandings occur, the platform provides targeted corrective feedback (Stage 5). Finally, the learner connects Pongal vocabulary to previously learned color and food words, and may add a family Pongal word to their personal Words module (Stage 6). This is not incidental language contact; it is architecturally structured linguistic transmission.

Cultural Embedding: The Festival Module

Rather than treating cultural content as supplementary enrichment, miABCTamil embeds cultural knowledge as a constitutive dimension of linguistic instruction. The Festivals module introduces learners to the ten major festivals of Tamil Nadu — Pongal, Thai Pusam, Karthigai Deepam, Aadi Perukku, Navarathri, and Karthigai among them — through the Tamil vocabulary of traditional foods, customary clothing, ritual practices, and seasonal significance.

This design choice reflects Byram's (1997) argument that intercultural competence requires not just linguistic accuracy but the interpretive frames through which cultural meanings are produced and received. A learner who can decode the letters of the word *Pongal* but does not know its significance — its connection to harvest, to the sun, to the ritual boiling of rice — has acquired a symbol without acquiring its referent. Cultural embedding ensures that Tamil script and Tamil meaning are encountered together.

The operational logic of this approach is corroborated by Zoupa and Karlis's (2025) findings on Heritage Language School administration. Their research demonstrates that the most effective HLS programs structure their curricula around precisely this integration: language instruction is delivered not as an isolated skills sequence but as a vehicle for cultural transmission, with festivals, historical narratives, and communal practices forming the core content through which linguistic competence is developed. miABCTamil translates this community-validated principle into a digital architecture, making it scalable and accessible to Tamil learners far beyond the geographic reach of institutional heritage schools.

AI Integration: Architecture and Oversight

Through integration with the companion web platform miabc.online, educators and parents can input custom Tamil or bilingual texts that are processed through a Bloom's Taxonomy-based question generation system. The AI system analyzes the semantic and structural features of the input text, classifies key concepts according to the cognitive levels of the revised taxonomy (Anderson and Krathwohl 2001), and generates comprehension questions designed to engage learners from basic recall through higher-order reasoning.

The pedagogical design rationale for this integration draws on Mayer's (2009) principles of multimedia learning — specifically, the coherence and signaling principles, which hold that learning is enhanced when instructional content is organized around the learner's cognitive architecture rather than the content's own internal logic — and on Sweller's (1988) cognitive load theory, which cautions that instructional design must manage the total cognitive demand placed on working memory.

The deployment of AI question generation in miABCTamil is explicitly designed to address the concern raised by Bennett and Abusalem (2024) regarding the risk that AI technologies may produce responses that satisfy surface-level academic criteria while bypassing the deeper cognitive engagement necessary for genuine learning. Their analysis advocates for a systematic shift — grounded in Bloom's Taxonomy — away from AI use that automates lower-order recall toward AI architectures that scaffold higher-order thinking. The miabc.online integration embodies this principle: rather than using AI to generate closed, fact-based questions, the system is calibrated to produce questions that require inference, application, and evaluation. Human review of all generated questions before deployment provides a further check on quality and cultural appropriateness.

Human oversight is structurally embedded in this process: all AI-generated questions are reviewed by educators or parents before deployment. This review layer is not an optional safeguard but an integral component of the system design. Automated question generation carries known risks — particularly the risk of

flattening cultural nuance, misclassifying culturally specific content, or generating questions that are technically valid but pedagogically inappropriate (Zheng 2020). The review step ensures that the pedagogical integrity of the Tamil-English learning experience is maintained by human judgment informed by cultural knowledge.

Passive Consumption versus Cognitive Scaffolding

The Architecture of Passive Digital Learning

The dominant design logic of contemporary educational applications — and of digital media more broadly — favors what might be called a *passive consumption architecture*: a loop of stimulus, response, and reward in which the learner is positioned as a receiver of information rather than a constructor of meaning. Gamified feedback systems, progress badges, and streak counters are effective tools for sustaining engagement, but engagement is not equivalent to learning (Gee 2003). A learner can maintain perfect streaks in a language application while processing its content at precisely the shallow level that Craik and Lockhart (1972) identified as insufficient for durable encoding.

For heritage languages, this problem is especially acute. Tamil cannot be adequately learned through surface-level matching and repetition, because Tamil meaning is often inseparable from its cultural and contextual frame. The word *thaai* (mother) carries not just its denotative meaning but a dense network of relational, affective, and literary associations that only become accessible through sustained interpretive engagement. An application that treats *thaai* as a vocabulary item to be matched against an image has given the learner a fragment of a language without giving them the language itself.

Scaffolding as Intentional Friction

miABCTamil introduces what might be termed *intentional friction* into the learning architecture: structured resistance to the passive consumption pattern. This friction is not arbitrary difficulty but deliberate cognitive demand calibrated to the learner's ZPD. Pre-reading activation questions require the learner to engage prior knowledge before encountering new text. Multi-level comprehension questions require analysis and evaluation rather than simple recall. Reflective prompts require the learner to articulate their understanding in their own words. Guided re-reading sequences prompt repair when comprehension breaks down.

Wood et al. (1976) identified the management of frustration as a central scaffolding function: effective support keeps the learner in productive struggle — challenged but not overwhelmed. miABCTamil achieves this through adaptive question difficulty, bilingual support structures that allow learners to access meaning in English when Tamil processing stalls, and a repair stage that addresses errors with explanation rather than mere correction.

The contrast between passive consumption and cognitive scaffolding is, at its core, a design distinction rather than a technological one. Bennett and Abusalem

(2024) make a closely related observation in the context of AI and higher education: the same generative technology can be deployed to automate cognitive work on behalf of the learner — replacing thinking rather than scaffolding it — or it can be structured to extend and deepen the learner's own cognitive engagement. The choice is architectural. miABCTamil is designed so that AI tools serve the latter function: generating questions that require the learner to do the cognitive work of recall, inference, evaluation, and synthesis rather than passively receiving pre-packaged answers.

The distinction between passive consumption and cognitive scaffolding is, ultimately, architectural. It is not a question of whether a platform is entertaining or serious, modern or traditional, but of whether its design structure produces shallow processing or deep encoding. A well-designed platform can be both engaging and cognitively demanding. miABCTamil is designed to be both.

Digital Classicism: A Proposed Framework

This paper proposes the concept of *digital classicism* as an original theoretical framework for understanding and designing digital environments that serve heritage and classical language education. Digital classicism, as defined here, is the intentional structuring of digital interaction architectures to preserve the interpretive depth, reflective rigor, and cultural density that characterize classical linguistic traditions. It is not a rejection of digital media but a deliberate redesign of the interaction principles that govern how digital media structures cognition.

Classical languages — and Tamil exemplifies the type — are not merely repositories of vocabulary and grammar. They are cognitive environments: they carry within their structures specific ways of knowing, of organizing experience, of making and receiving meaning. Classical Tamil poetry operates through systems of *akam* (interior, erotic) and *puram* (exterior, heroic) that presuppose a reader capable of recognizing the conventions and generating the appropriate interpretive response. A digital platform that reduces classical Tamil to word-matching exercises does not merely fail to preserve the tradition; it actively teaches learners to encounter Tamil in a mode incompatible with that tradition's own cognitive demands.

Digital classicism proposes three design principles as responses to this problem. First, the *depth principle*: every learning interaction should require semantic processing rather than permitting surface-level response. Second, the *cultural embeddedness principle*: cultural meaning must be constitutive of linguistic instruction, not supplementary to it. Third, the *reflective architecture principle*: the design must structurally require pauses for metacognitive monitoring, interpretive effort, and consolidation. These principles are instantiated in miABCTamil's six-stage cognitive architecture and its cultural embedding strategy.

These principles are grounded not only in theoretical frameworks but in documented community practice. Zoupa and Karlis (2025) demonstrate that Heritage Language Schools which sustain strong cultural embedding — integrating festivals, community history, and traditional arts into the language curriculum — are precisely those that report stronger learner engagement and cultural identity outcomes. Digital classicism can be understood, in this light, as the architectural translation of proven

HLS principles into scalable digital form: the depth principle corresponds to the deep linguistic instruction of effective HLS programs; the cultural embeddedness principle mirrors the inseparability of language and culture that administrators in Zoupa and Karlis's study consistently emphasize; and the reflective architecture principle addresses the gap in current digital tools identified by Bennett and Abusalem (2024), whose analysis calls for learning environments that structurally require higher-order cognitive engagement rather than leaving it to individual initiative.

Digital classicism, as a framework, is intended to be transferable beyond Tamil to other classical heritage languages — Sanskrit, Classical Arabic, Ancient Greek, Classical Chinese — that face analogous pressures from digital-native learning environments. The specific content and cultural context will necessarily vary; the architectural principles apply across the type.

Implications for Heritage Language Education

Transferability of the Scaffolding Architecture

The six-stage cognitive architecture proposed in this paper — Activate, Decode, Interpret, Reflect, Repair, Integrate — is a domain-general design framework whose content is culturally specific but whose cognitive logic is transferable. Any heritage language community seeking to develop digital literacy tools faces the same core design problem: how to structure interaction so that deep processing, not surface engagement, is the default cognitive mode. The miABCTamil architecture offers one principled solution to that problem, grounded in established learning theory and developed through iterative design practice.

Future work might examine the extent to which this architecture, stripped of its Tamil-specific content, can be deployed as a template for other heritage language platforms — and whether its cognitive scaffolding effects are robust across different learner populations, age groups, and linguistic typologies.

Bilingualism as Cognitive Resource

miABCTamil treats bilingualism not as a problem to be managed but as a cognitive resource to be leveraged. Cummins' (1979) linguistic interdependence hypothesis provides the theoretical warrant: literacy skills transfer across languages when the first language is sufficiently developed. English is used in miABCTamil not to replace Tamil but to support access to Tamil meaning during the early stages of acquisition, and progressively to recede as Tamil competence grows. This design choice reflects the platform's commitment to additive bilingualism — the enrichment of the learner's linguistic repertoire — rather than subtractive bilingualism, which treats heritage language maintenance as a barrier to dominant language acquisition (Baker 2011).

Family and Community Engagement

Heritage language transmission is not solely a pedagogical problem; it is a social and familial one. Montrul (2016) observes that the home domain is the primary site of heritage language exposure for diasporic learners, and that parental language use is among the strongest predictors of heritage language maintenance. miABCTamil's architecture reflects this by building family engagement into the platform's core functionality: family members can record their own voice pronouncing Tamil words, add family-specific vocabulary to the Words module, and access the platform's Family module to document family names and relationships in Tamil. The platform is not merely a pedagogical tool; it is a family language resource.

This design commitment is reinforced by the evidence base on Heritage Language School practice. Zoupa and Karlis (2025) found that community and family involvement is among the most consistently cited success factors in HLS administration: schools that maintain active parent engagement, community cultural events, and intergenerational learning activities demonstrate stronger outcomes in both linguistic competence and cultural identity. Their study identifies the absence of such engagement as one of the primary weaknesses facing HLS programs — a weakness that miABCTamil's family-integrated architecture is specifically designed to address in the digital domain. By enabling family members to contribute voice recordings, add culturally specific vocabulary, and participate in the learner's progress, the platform extends the community engagement logic of effective heritage schools into a form that does not require physical proximity or institutional infrastructure.

Limitations and Future Directions

This paper presents a design-based research contribution (McKenney and Reeves 2019): it articulates the theoretical rationale and architectural logic of miABCTamil rather than reporting measured outcome data. This is a principled methodological choice appropriate to the current stage of the platform's development, but it carries significant limitations that must be acknowledged clearly.

No empirical data on learning outcomes, comprehension gains, or identity measures are reported in this paper. All claims regarding the platform's cognitive effects are design-intentional — they describe what the architecture is designed to produce — rather than evidential. The theoretical frameworks cited provide strong theoretical warrant for the design decisions, but warrant is not evidence. Future research must examine: (1) whether learners who use miABCTamil demonstrate measurably greater comprehension gains than learners using comparison platforms; (2) whether the platform's cultural embedding strategy produces stronger identity alignment with Tamil heritage over time; (3) whether the six-stage cognitive architecture generalizes across age groups, from early childhood through adult heritage learners; and (4) whether the AI-generated question quality holds up against expert teacher judgment in comparative validity studies.

Additionally, the current paper does not report usability testing data, accessibility evaluations, or teacher training outcomes. Each of these is a necessary component of a full design-based research program. The platform's integration with miabc.online

introduces additional research questions around educator uptake, the quality of parent-reviewed AI-generated content, and the long-term sustainability of community engagement features.

The concept of digital classicism, introduced in Section 5, requires further theoretical elaboration and empirical operationalization. As an original coinage, it needs to be tested against cases, refined through critique, and situated more precisely within adjacent scholarship on digital humanities, heritage linguistics, and educational technology design. The framework proposed here is necessarily preliminary.

These limitations are not dismissals of the contribution. A well-articulated design framework grounded in established theory and developed through iterative practice is a legitimate and necessary precursor to empirical investigation. This paper establishes the theoretical and architectural foundation; the empirical program it calls for is the work of subsequent phases.

Conclusion

Digital technologies do not inherently diminish heritage languages. The problem is not the medium; it is the architecture. When digital platforms are designed around the logic of passive consumption — rapid response, surface engagement, reward cycles — they produce learners who can navigate the interface but cannot inhabit the language. For a classical heritage language like Tamil, which demands interpretive depth, cultural attunement, and reflective engagement, this architectural failure is not a minor inconvenience. It is a mechanism of language loss dressed in the clothing of language learning.

miABCTamil is a response to this architectural problem. By grounding its design in levels-of-processing theory, Vygotskian scaffolding, Bloom's revised taxonomy, and heritage language acquisition research, the platform constructs a learning environment in which cognitive depth is the default mode rather than an exceptional achievement. Its six-stage cognitive architecture — Activate, Decode, Interpret, Reflect, Repair, Integrate — provides a transferable model for digital heritage literacy design. Its cultural embedding strategy treats Tamil festivals, family structures, and literary traditions not as decorative enrichment but as the living content through which language meaning is constructed and transmitted.

miABCTamil can be incorporated into the existing Tamil language curriculum as a supplementary digital resource that enables learners to practise and reinforce classroom learning at their own pace, while teachers use miabc.online to generate Bloom-aligned comprehension questions from their own curricular texts (Anderson and Krathwohl 2001). Beyond the initial pilot, deployment will proceed in iterative design-based phases (McKenney and Reeves 2019): refinement with participating schools and families, expansion to additional Tamil community and diaspora programs supported by educator onboarding, and eventual adaptation of the architecture for other heritage languages.

The concept of digital classicism, proposed in this paper, offers a broader theoretical frame for this work. Classical languages are not relics to be preserved in digital amber. They are living cognitive traditions that demand living pedagogies —

pedagogies capable of harnessing the reach and interactivity of digital media while refusing to surrender the interpretive depth that makes those traditions worth transmitting. Technology, intentionally designed, can serve this purpose. miABCTamil demonstrates how.

Tamil has survived for over two thousand years not because it was preserved passively but because each generation found new forms through which to transmit it with full cognitive and cultural intensity. Digital classicism is one such form for the present generation. The ancient language of Thiruvalluvar belongs in the digital age — but only on terms that honor the depth of the tradition it carries.

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