

Word Spacing, Audio Support, and Cultural Content in Digital Thai Reading Instruction: A Case Study of the Easy Thai Read Application, with a Thematic Analysis of Learner Discourse

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Received: July 2026; Revised: August, 2026; Accepted: August 2026

Abstract

Thai orthography poses distinct challenges for beginning readers, most notably its absence of interword spacing and its layered tonal marking system. This paper reports a two-strand qualitative study examining how a mobile application, Easy Thai Read, which digitises the widely used *Manee* primer series, supports beginning level reading acquisition through three design features: interword spacing, synchronised audio narration, and culturally embedded content. The study is underpinned by an integrated conceptual framework combining Cognitive Load Theory (Sweller, 1988), Dual Coding Theory (Paivio, 1986), and Sociocultural Theory (Vygotsky, 1978), which together explain why segmentation support, audio-text pairing, and culturally authentic content might be expected to aid acquisition. Data were drawn from two sources: a structured case study of a single anonymised false-beginner learner's engagement with the application, and a netnographic thematic analysis of publicly available, anonymised discussion threads from Thai-learning online communities. Braun and Clarke's (2006) six-phase thematic analysis procedure was applied across both datasets to identify convergent themes. Five themes emerged: segmentation as the primary barrier to fluency; the limits of visual literacy without auditory grounding; consonant class and tone-rule memorisation as a discrete sub-skill; cultural and motivational engagement with authentic content; and the role of structured retrieval practice in consolidation. The findings indicate that the application's design features map closely onto challenges independently reported across a wider learner population, lending the case study findings greater credibility than a single-participant design would otherwise support. The paper concludes with a revised conceptual model and design recommendations for computer-assisted language learning (CALL) tools targeting Thai and related unspaced scripts.

Keywords: Thai language acquisition, word spacing, scriptio continua, dual coding theory, cognitive load theory, netnography, *Manee* series, computer-assisted language learning

Introduction

Southeast Asia is home to a cluster of writing systems, among them Thai, Lao, Khmer, Burmese, and Javanese, that descend from the Brahmi script tradition transmitted across the region roughly between the seventh and thirteenth centuries (Daniels & Bright, 1996). While these scripts share a common ancestry, each has evolved distinctive conventions for representing vowels, consonant clusters, and, in several cases, lexical tone. One structural feature shared by Thai, Lao, Khmer, and Burmese in particular is the absence of systematic spacing between words, a phenomenon linguists term *scriptio continua*. Because these languages do not mark word boundaries visually, readers must rely on morphological, syllabic, and contextual cues to segment continuous strings of characters into meaningful units (Kohsom & Gobet, 1997; Winskel, 2013).

For Thai specifically, this challenge is compounded by a tone system that is partly encoded through diacritics interacting with consonant class and vowel length. Readers must therefore process segmental and suprasegmental information simultaneously, a demand with no direct parallel in non-tonal alphabetic systems. Thai's non-linear vowel placement, whereby vowels may appear before, after, above, or below their associated consonant, and multiple graphemes often combine to represent a single vowel sound, adds a further layer of complexity (Winskel, 2019).

Despite a substantial descriptive literature on these orthographic properties, comparatively little research has examined how specific digital design features, considered together within a coherent theoretical model, address the distinct cognitive and sociocultural demands of Thai reading acquisition. Most existing evaluations of Thai literacy technology report efficiency indices or pre/post test gains without articulating why a given feature (for example, audio pairing) should be expected to work, or triangulating small-sample findings against the wider learner population. This paper addresses that gap by combining a structured single-case evaluation of the Easy Thai Read application with a systematic thematic analysis of naturally occurring learner discourse, interpreted through an explicit, integrated conceptual framework.

Problem Statement

Conventional approaches to teaching Thai reading have historically emphasised rote memorisation of the alphabet and consonant classes, with comparatively little structured, theoretically grounded support for the transition from character recognition to fluent word and sentence parsing. Existing empirical evaluations of Thai literacy applications tend to be atheoretical and outcome-focused, reporting whether an intervention worked without specifying the mechanism through which it was expected to work. This study addresses that gap by evaluating Easy Thai Read against an explicit conceptual framework, and by triangulating a single learner's structured feedback against a broader corpus of learner-reported experience.

Significance of the Study

This paper contributes to three overlapping bodies of scholarship: research on reading acquisition in unspaced Southeast Asian scripts, cognitive and sociocultural theories of multimedia and language learning, and the design literature for CALL tools. By grounding the analysis in an integrated theoretical framework and by triangulating case study data against a thematically analysed corpus of learner discourse, the study offers findings with greater transferability than a single-participant case study alone, and provides theoretically motivated design guidance applicable to Thai and other *scriptio continua* languages such as Lao, Khmer, and Burmese.

Theoretical Framework

This study is underpinned by an integrated conceptual framework drawing on three complementary theoretical traditions, each of which corresponds to one of the application features under examination.

Cognitive Load Theory and Word Spacing

Cognitive Load Theory (Sweller, 1988, 2011) proposes that working memory has limited capacity, and that instructional design should minimise extraneous cognitive load (effort expended on processing demands irrelevant to the learning goal) so that capacity remains available for germane load (effort directly building schema). Applied to reading acquisition in an unspaced script, the absence of interword spacing imposes an additional segmentation task that is extraneous to the core goals of lexical recognition and comprehension, particularly for beginning readers who have not yet automatised syllable and word boundary detection. Within this framework, artificial word spacing can be understood as a scaffold that temporarily removes an extraneous processing demand, freeing working memory capacity for vocabulary recognition and meaning construction. As automaticity develops, this scaffold would be expected, on theoretical grounds, to become progressively unnecessary and, if retained indefinitely, potentially counterproductive to the development of authentic segmentation skill.

Dual Coding Theory and Audio–Text Pairing

Dual Coding Theory (Paivio, 1986, 1991) proposes that verbal and non-verbal (including auditory) information are processed through partially independent channels, and that information encoded through both channels simultaneously is more robustly represented in memory than information encoded through a single channel alone. Applied to tonal language acquisition, this framework predicts that pairing written Thai text with synchronised native-speaker audio should support stronger encoding of tone and pronunciation than text presented in isolation, because tonal information communicated primarily through diacritic marking is inherently under-specified relative to the acoustic signal. This offers a theoretical account of why audio overlays might be expected to support not merely comprehension but the phonological representation underlying spoken production.

Sociocultural Theory and Culturally Embedded Content

Vygotsky's (1978) sociocultural theory frames learning as inherently mediated by cultural tools and social context, a perspective extended within language education by culturally responsive and culturally sustaining pedagogy (Gay, 2018; Ladson-Billings, 1995), which argues that learning materials embedding authentic cultural content support both motivation and the acquisition of pragmatic and sociolinguistic competence, over and above narrowly linguistic gains. Within this framework, the *Manee* series can be understood not merely as a source of graded vocabulary but as a cultural artefact mediating learners' access to Thai social norms, values, and communicative conventions.

An Integrated Model

Figure 1 (described textually, given the constraints of this format) situates these three theoretical strands as complementary rather than competing: Cognitive Load Theory addresses the *segmentation* demand of Thai orthography, Dual Coding Theory addresses the *tonal and phonological* demand, and Sociocultural Theory addresses the *motivational and pragmatic* dimension of reading acquisition. The present study uses this tripartite framework both to structure data collection (the four feedback dimensions described in Section 4) and to interpret convergence between the case study and the thematic analysis of learner discourse.

Literature Review

Orthographic Challenges of Unspaced Southeast Asian Scripts

Several Southeast Asian languages present comparable challenges to learners accustomed to spaced, alphabetic orthographies. Personal accounts of learning Lao, for instance, describe the unfamiliarity of an entirely new character inventory combined with the absence of interword spacing as compounding difficulties, particularly given Lao's predominantly monosyllabic word structure (Roper, 2014). Burmese presents a related but distinct set of obstacles: its script blends syllabic and alphabetic principles, uses diacritics that do not map predictably onto sound changes, and similarly lacks reliable word boundary marking, requiring learners to depend heavily on contextual inference (Roop, 1972).

In Cambodia, the debate over Khmer orthography illustrates that the absence of spacing and punctuation is not merely a technical inconvenience but a matter of ongoing sociolinguistic contention. Reform advocates have argued that the introduction of commas and word spaces would meaningfully improve clarity, particularly for learners and for readers unfamiliar with specialised or technical vocabulary, although this position has met resistance from those who maintain that mastery of Khmer syntax alone is sufficient for clear communication (Willemyns, 2016).

Word Spacing and Reading in Thai

Empirical work specifically on Thai has generally supported the idea that interword spacing aids word recognition, even though its effects appear less pronounced than in already spaced languages. Using eye-tracking methodology, Winskel (2009) compared Thai-English bilinguals and English monolinguals reading spaced and unspaced Thai and English text, finding that while interword spaces facilitated word recognition in Thai, they did not substantially alter eye-guidance behaviour or lexical segmentation strategies in the way that space removal disrupted English reading. Complementing this, Kohsom and Gobet (1997) found that adding spaces to Thai text improved both reading speed and accuracy, and that this benefit did not interact with the semantic predictability of the text; notably, they also found that the ability to read unspaced Thai text did not transfer to unspaced English, underscoring the language-specific nature of segmentation skill. Slayden (2010) further notes that Thai spacing conventions, where present, typically mark clause or sentence boundaries rather than word boundaries, which can itself be a source of confusion for learners who assume spacing functions analogously to European punctuation norms.

Thai Orthography and Literacy Development

Winskel (2019) provides a comprehensive account of Thai's orthographic architecture, noting its syllabic characteristics, its non-linear vowel placement, and the generally consistent, though not one-to-one, mapping between graphemes and phonemes. She observes that spelling proficiency in Thai children typically lags behind reading proficiency, a pattern attributed to the multiple grapheme sequences that can represent single phonemes. In a related study, Winskel and Iemwanthong (2010) found a clear lexicality effect, with beginning readers relying predominantly on a lexico-syllabic processing unit rather than smaller phoneme-level units, and observed rapid gains in accuracy between Grade 1 and Grades 2 and 3.

Technology-Enhanced Approaches to Thai Literacy

A substantial and growing body of applied research has evaluated technology- and design-based interventions for Thai reading instruction, predominantly among school-aged native-speaker populations. Augmented reality platforms combined with picture-word inductive teaching strategies have shown measurable gains in reading comprehension among young Thai learners (Nasongkhla & Sujiva, 2023). Smart training application interventions targeting Grade 1 students have demonstrated efficiency scores exceeding standard 80/80 benchmarks alongside statistically significant post-intervention reading gains (Thanavanitchayakul & Srichok, 2024). Brain-based learning instructional models have likewise produced significant improvements in reading and writing outcomes among both

mainstream and non-formal education populations (Intasena et al., 2023; Worapongpat, 2026), and Cooperative Integrated Reading and Composition methods have been applied successfully to Thai-as-a-second-language instruction among ethnic minority students (Besae, 2024).

Beyond native-speaker instruction, structured textbook development has been shown to improve measurable communicative competence among adult foreign learners of Thai, alongside high self-reported satisfaction (Fahkrajang & Fongsrung, 2026), and tailored learning packages for undergraduate communication coursework have produced significant pre-to-post gains and positive learner attitudes (Srisawat, 2021). User-centred mobile application design employing design-thinking methodology has also been used to iteratively refine vocabulary-acquisition interfaces for Thai learners (Krishnavarty et al., 2022). Collectively, these studies indicate consistent, if methodologically heterogeneous and largely atheoretical, support for structured, technology-mediated interventions in Thai literacy instruction. Notably absent from this literature is an explicit theoretical account linking specific design features, such as spacing or audio pairing, to the cognitive or sociocultural mechanisms through which they are hypothesised to operate, a gap the present study seeks to address.

Methodology

Design

This study employed a two-strand qualitative design comprising (a) a structured single case study of an anonymised learner's engagement with the Easy Thai Read application, and (b) a netnographic thematic analysis (Kozinets, 2002, 2015) of publicly available, anonymised discussion threads drawn from Thai-learning online communities. Netnography adapts ethnographic principles to naturally occurring online discourse and is well suited to capturing learner-reported experience at a scale and in a form of candour not readily obtainable through interview or survey methods, since community members post about their difficulties unprompted and in the absence of researcher influence. Both datasets were analysed using Braun and Clarke's (2006) six-phase thematic analysis procedure: familiarisation, initial coding, searching for themes, reviewing themes, defining and naming themes, and producing the final analysis. Coding was conducted deductively against the three constructs specified in the theoretical framework (segmentation load, audio-tonal encoding, cultural-motivational engagement) while remaining open to inductively emergent themes not anticipated by the framework.

Case Study Participant and Procedure

A single participant, functioning as a "false beginner" (already familiar with the Thai alphabet but not yet fluent in connected-text reading), engaged with the Easy Thai Read application across a structured series of sessions. To preserve anonymity, no identifying demographic or biographical detail is reported, and no direct quotations from the participant's feedback are reproduced verbatim. Feedback was elicited around four dimensions derived from the theoretical framework: (a) the influence of interword spacing on reading fluency (Cognitive Load Theory), (b) the contribution of audio narration to pronunciation and tone recognition (Dual Coding Theory), (c) the role of tone markings in supporting tone discrimination, and (d) the extent to which the cultural content embedded in the *Manee* narratives was perceived as meaningful (Sociocultural Theory). The participant additionally reflected on the application's post-lesson vocabulary quiz feature.

Online Discourse Corpus and Procedure

The second dataset comprised publicly accessible discussion threads from Thai-learning online communities in which participants discussed difficulties, strategies, and resources for

learning to read Thai. Threads were selected for direct relevance to reading acquisition, word segmentation, tone learning, or reading application use. In accordance with ethical guidelines for research using publicly available online data (British Psychological Society, 2021; Kozinets, 2015), all usernames have been removed and replaced with non-identifying codes (e.g., Forum Participant A), and no verbatim text exceeding conventional fair-use limits is reproduced; all reported content is paraphrased and thematically synthesised rather than quoted directly. Because the platforms from which this discourse was drawn host discussions visible to the general public and do not require membership approval for viewing, and because no attempt was made to interact with, survey, or identify individual posters, the analysis is treated as analogous to the study of published, publicly archived text rather than as human subjects research involving direct participant contact.

Trustworthiness

Trustworthiness was addressed following Lincoln and Guba's (1985) criteria. Credibility was supported through triangulation between the case study and the discourse corpus, such that themes retained in the final analysis were those evidenced across both data sources. Dependability was supported through the systematic application of Braun and Clarke's (2006) coding procedure, with codes and candidate themes iteratively reviewed against the raw data. Confirmability was supported by explicitly separating deductive codes derived from the theoretical framework from inductively emergent codes. Transferability, while necessarily limited by the qualitative and non-random nature of both samples, is enhanced relative to a single-case design by the breadth of independent learner voices represented in the discourse corpus.

Results and Discussion

Thematic analysis of the combined dataset produced five themes, each evaluated against the theoretical framework and illustrated with reference to both the case study participant and the discourse corpus.

Theme 1: Segmentation as the Primary Barrier to Fluency

Across the discourse corpus, the absence of interword spacing was repeatedly identified, independently of any specific application, as the single most disorienting feature of Thai text for learners transitioning from spaced orthographies. Several forum participants described the experience of reading unspaced Thai as comparable to reading a continuous, unbroken string of English letters, and noted that even after acquiring reasonable knowledge of individual consonants and vowels, identifying where one word ended and the next began remained a distinct and separately acquired skill. This is consistent with the case study participant's report that the presence of artificial spacing substantially reduced the effort required to identify individual lexical units, and directly supports the Cognitive Load Theory prediction that segmentation constitutes an extraneous processing demand separable from lexical recognition itself (Sweller, 1988). The convergence of this theme across an independent, unprompted body of learner discourse and the structured case study substantially strengthens confidence in the plausibility of the spacing mechanism proposed in Section 2.1, beyond what the single case alone could support.

Theme 2: The Limits of Visual Literacy Without Auditory Grounding

A second, closely related theme concerned the distinction learners drew between visual decoding ability and genuine spoken competence. Multiple forum participants argued, at times forcefully, that reading skill developed in isolation from sustained listening practice produces readers who can decode script without being able to understand or be understood in spoken interaction, and that the written form is, at best, an imperfect and partial representation of the tonal and phonological reality of spoken Thai. This theme extends

beyond the case study's more narrowly framed appreciation of audio for pronunciation support, and suggests that audio-text pairing addresses not a peripheral convenience but what a substantial portion of the learner community regards as the central mechanism of tonal language acquisition. This is directly consistent with Dual Coding Theory's prediction that tonal information, being under-specified in diacritic form, requires auditory encoding to be robustly represented (Paivio, 1986).

Theme 3: Consonant Class and Tone Rule Memorisation as a Discrete Sub-Skill

A recurring, more procedural theme in the discourse corpus concerned strategies for memorising the classification of Thai consonants into high, medium, and low tone classes, a system several participants described as arbitrary from a foreign learner's perspective even though native speakers may acquire the same distinctions implicitly through auditory exposure in childhood. Participants reported using varied strategies, including flashcards, colour-coding by class, and phonetic "family resemblance" heuristics, to consolidate this knowledge. While outside the direct scope of the Easy Thai Read case study, this theme indicates that tone-class memorisation represents a distinct cognitive sub-task, separable from both segmentation and general tone perception, and suggests that applications might usefully treat consonant-class scaffolding as an independent design feature rather than assuming it is adequately addressed through general audio exposure alone.

Theme 4: Cultural and Motivational Engagement with Authentic Content

Consistent with the Sociocultural Theory strand of the framework, both datasets indicated that authentic, culturally embedded reading material carried value beyond narrow vocabulary acquisition. The case study participant reported that the *Manee* narratives conveyed norms such as respect for elders and polite conduct, offering insight into Thai social expectations. Corroborating this, forum participants who had used graded reading resources based on the same or similar traditional primer material frequently expressed considerable enthusiasm for these resources, several noting that they had actively sought out archived or alternative copies of the *Manee* series specifically because of its perceived authenticity and effectiveness, relative to more generic or artificially generated learning texts. This convergence supports the theoretical claim that culturally authentic content contributes independently to motivation and engagement (Gay, 2018; Ladson-Billings, 1995), rather than functioning merely as a vehicle for linguistic content that could equally be delivered through culturally neutral material.

Theme 5: Structured Retrieval Practice and Retention

Finally, both datasets pointed to the importance of structured, repeated retrieval practice in consolidating new vocabulary. The case study participant valued the application's randomised post-lesson quiz feature for reinforcing retention. Independently, forum participants frequently recommended spaced-repetition systems as, in their view, close to indispensable for retaining the large initial inventory of consonants, vowels, and tone rules, describing dedicated flashcard-based memorisation as the most efficient route to initial mastery of the character set, followed by sustained, graded reading practice to build fluency. This convergence supports the incorporation of spaced-repetition and active-recall principles as a core rather than peripheral design feature of Thai reading applications.

Summary of Thematic Convergence

Table 1 (described textually) summarises the mapping between theoretical constructs, case study findings, and discourse corpus themes.

Theoretical construct	Case study finding	Corpus theme	Convergence
Cognitive Load Theory (segmentation)	Spacing reduced decoding effort	Theme 1: segmentation as primary barrier	Strong

Theoretical construct	Case study finding	Corpus theme	Convergence
Dual Coding Theory (audio–tone)	Audio aided pronunciation and tone	Theme 2: limits of visual-only literacy	Strong
(Emergent, procedural)	Not directly assessed	Theme 3: tone-class memorisation strategies	Corpus-only
Sociocultural Theory (culture)	Cultural content valued	Theme 4: authenticity and motivation	Strong
Retrieval practice	Quiz aided retention	Theme 5: spaced repetition and active recall	Strong

Four of five themes showed strong convergence between the case study and the independently derived discourse corpus, lending the case study's findings considerably greater credibility than would be warranted by a single-participant design in isolation. Theme 3 emerged only from the discourse corpus, indicating a design consideration not directly captured by the application's current feature set nor by the structured feedback dimensions used in the case study.

The convergence between a single structured case study and an independently derived corpus of learner discourse offers a stronger evidential basis for the study's conclusions than either source could provide alone, and allows the findings to be interpreted with reference to an explicit theoretical framework rather than as an atheoretical list of favourably received features.

The strong convergence observed for Theme 1 substantiates the Cognitive Load Theory account of word spacing: segmentation appears reliably, across an independent and much larger set of learner voices, to function as an extraneous processing demand that visual spacing scaffolds can temporarily offload, consistent with prior experimental findings that interword spacing improves word recognition speed and accuracy in Thai (Kohsom & Gobet, 1997; Winskel, 2009). The theoretical framework further suggests, however, that such scaffolding should be conceived as a fading structure rather than a permanent feature, since the ultimate goal of reading acquisition is authentic engagement with unspaced text.

The convergence observed for Theme 2 extends the audio-related literature meaningfully. Whereas prior research (Kohsom & Gobet, 1997) frames auditory support primarily as an aid to reading efficiency, the discourse corpus suggests that a substantial portion of the learner community regards listening practice as ontologically prior to reading competence in a tonal language: that is, the written form is treated as derivative of, and only meaningful in reference to, the spoken language it represents. This is precisely the mechanism predicted by Dual Coding Theory, wherein tonal information under-specified in diacritic form requires auditory encoding for robust representation (Paivio, 1986, 1991).

Theme 3, emerging only from the discourse corpus, represents the clearest empirical contribution of the triangulated design over the case study alone. Because consonant class and tone rule memorisation was not one of the four structured feedback dimensions elicited from the case study participant, this sub-skill was invisible to the single-case component of the study, yet emerged clearly and repeatedly across the independent corpus. This suggests that Thai reading applications, including Easy Thai Read, may benefit from an explicit, isolated module addressing consonant class memorisation as a discrete design feature, rather than assuming this knowledge will be acquired incidentally through general reading and audio exposure.

The convergence for Theme 4 substantiates the Sociocultural Theory strand of the framework, indicating that authentic cultural content, exemplified by the *Manee* series,

provides motivational and pragmatic value that a culturally neutral equivalent would not (Gay, 2018; Ladson-Billings, 1995). The strength of learner enthusiasm for this specific resource in the discourse corpus, extending to active efforts to locate legacy or alternative copies of the material, suggests that cultural authenticity is not a peripheral design consideration but a factor materially affecting learner engagement and persistence.

Finally, the convergence for Theme 5 supports incorporating spaced-repetition and active-recall principles as core, rather than supplementary, features of Thai reading applications, consistent with the broader second-language vocabulary acquisition literature and with prior Thai-specific application design work (Krishnavarty et al., 2022).

Revised Conceptual Model

Integrating these findings, the tripartite framework proposed in Section 2 can be refined to include a fourth element, structured retrieval practice, operating in parallel to, rather than subsumed within, the three original constructs, and to specify that the Cognitive Load Theory-derived spacing scaffold should be conceived as a fading structure calibrated to individual proficiency rather than a fixed feature.

Limitations

Several limitations qualify these findings. First, although the discourse corpus substantially strengthens the transferability of the case study findings relative to a single-participant design, both data sources remain qualitative and self-report in nature, and neither provides objectively measured reading-speed or accuracy data. Second, the discourse corpus was not randomly sampled and may over-represent particularly engaged or vocal community members, a limitation inherent to netnographic methods generally (Kozinets, 2015). Third, Theme 3 indicates that the structured feedback dimensions used in the case study did not fully anticipate the range of challenges reported by the wider learner community, suggesting that future single-case evaluations of this kind should incorporate a broader, corpus-informed set of feedback dimensions from the outset. Future research should address these limitations through larger-sample, mixed-methods designs incorporating objective reading-speed and accuracy measures alongside qualitative data.

Design Recommendations

Based on the theoretically framed and empirically triangulated findings, five recommendations emerge for future development of Thai reading applications. First, applications should offer adaptive, fading spacing scaffolds, calibrated to individual proficiency rather than fixed. Second, high-quality synchronised native-speaker audio should be treated as a core feature grounded in Dual Coding Theory, with adjustable playback speed and, where feasible, integrated listening-only practice modes reflecting the corpus finding that listening is regarded by many learners as foundational rather than supplementary. Third, an explicit, isolated consonant-class and tone-rule module should be incorporated, addressing Theme 3 directly rather than relying on incidental acquisition through reading and audio exposure alone. Fourth, reading material should be selected for genuine cultural authenticity, following the model offered by graded readers such as the *Manee* series, rather than culturally neutral generated text. Fifth, vocabulary consolidation features should be built around spaced-repetition and active-recall principles rather than simple end-of-lesson review.

Conclusion

This study examined the Easy Thai Read application through a two-strand qualitative design combining a structured single case study with a netnographic thematic analysis of independent learner discourse, interpreted through an integrated theoretical framework drawing on Cognitive Load Theory, Dual Coding Theory, and Sociocultural Theory. Strong

convergence across four of five identified themes substantiates the theoretical mechanisms proposed for word spacing, audio-tonal pairing, and cultural embedding, while a fifth theme, consonant class memorisation, emerging only from the discourse corpus, illustrates the value of triangulating single-case findings against a broader body of learner-reported experience. The findings offer a theoretically grounded and empirically corroborated set of design principles for future CALL tools targeting Thai and, potentially, other unspaced Southeast Asian scripts such as Lao, Khmer, and Burmese.

Future Research Directions

Future work should expand this line of inquiry through larger and more diverse samples spanning multiple proficiency levels, incorporating objective reading-speed and accuracy measures alongside qualitative data, and testing the revised conceptual model proposed in Section 6.1 through controlled comparison of applications with and without fading spacing scaffolds, integrated tone-class modules, and spaced-repetition consolidation features. Comparative studies contrasting application-based instruction with traditional classroom methods would help clarify the relative contribution of specific design features. Longitudinal designs tracking reading fluency and vocabulary retention over extended periods would help establish whether early reliance on spacing and audio support yields lasting gains or requires deliberate fading strategies to ensure transfer to authentic, unspaced Thai text. Finally, given ongoing debates around punctuation reform in Khmer and other Southeast Asian scripts (Willemyns, 2016), future research might productively examine whether the tripartite theoretical framework proposed here transfers to the design of reading applications for these related orthographies.

Declaration

No financial incentives were offered to or received by the author in connection with this study. All participant and forum data have been anonymised, and no identifying information is reported. Publicly available online discourse was analysed in accordance with ethical guidelines for internet-based research (British Psychological Society, 2021; Kozinets, 2015).

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