

EDUCATIONAL PSYCHOLOGY APPROACHES TO DIGITAL PHONICS FOR EARLY LITERACY IN INDIGENOUS PRESCHOOL POPULATIONS: A NARRATIVE REVIEW

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Abstract: *This narrative review summarises education psychology principles that inform digital phonics interventions for early literacy of Indigenous preschool children, focusing on theoretical basis, effectiveness and issues related to culture. There are strong lifelong educational and life outcomes associated with early literacy, however Indigenous preschool children remain at risk of poor literacy outcomes. Digital phonics intervention has become an increasingly scalable approach to teaching letter–sound correspondences and early decoding skills. While Indigenous-focussed literacy initiatives of this kind are on the rise, there are still questions that remain about their cultural relevance and appropriateness to our ways of learning and sustaining achievements in reading across different contexts. A narrative review method was applied to critically analyse peer reviewed empirical, theoretical and conceptual literature that was identified in the major education and psychology databases as well as additional reference searches. Thematic synthesis of links were made across educational psychology theory, intervention design, cultural relevance and implementation considerations. Digital phonics interventions based on principles from education psychology such as phonological awareness, scaffolding and motivation can be used to encourage the development of early literacy skills. However, findings are mixed and predominantly cross-sectional, with limited culturally responsive design, integration of Indigenous languages and epistemologies, and longitudinal evaluation. There is on-going tension between standardised phonics programs and culturally situated, strengths-based ones. The paper emphasizes that digital phonics interventions are more successful when bounded in culturally responsive, community-based and whole of early years/foundations literacy frameworks. Longitudinal mixed methods research led by Indigenous people is needed to ensure that literacy outcomes are both equitable and sustainable.*

Keywords: *Digital phonics, early literacy, Indigenous preschool children, educational psychology, culturally responsive education, early childhood education*

Introduction

Early literacy development is a key predictor of academic, social, and economic competitive advantage that drives the long-term status attainment of children and is therefore a central focus for educational psychology as well as early childhood education literature. (Anthony & Francis, 2023) Early literacy achievement gaps for Indigenous preschool children continue to be a global challenge, influenced through historical marginalisation, linguistic diversity, and cultural dissonance between school and home, as well as access to high-quality educational opportunities. (Nakata et al., 2020) Digital phonics interventions in the last decades, there has been a surge of digital technology-based intervention of phonics programs aimed at teaching letter sound relationships and decoding that are suggested to be scalable supports with the development of early reading. These interventions are informed by theories of cognitive development, phonological processing, motivation and scaffolded learning from an educational psychology point of view. (Mayer, 2020) Although there is evidence that digital phonics programs can improve early literacy results, their potential to benefit and be appropriate for Indigenous preschool children has been less well examined. (Bishop et al., 2022)

Recent research underscores promising developments in adaptive learning technologies, and multimedia instruction but also identifies needs with regard to culturally responsive design; language transfer from Indigenous languages to English; and the role of community and educator mediation. (Bus et al., 2021) Current debates are about whether standardised digital phonics programs accurately represent Indigenous ways of learning or served to perpetuate deficit models. (Bishop et al., 2022)

The purpose of this narrative review is to characterize educational psychology frameworks of digital phonics interventions designed for early literacy in an Indigenous preschool population. (Graham et al., 2023) Definitions of key terms, such as phonological awareness, phonics, and digital intervention are provided to facilitate readers' comprehension. The review aggregates theories and interventions, and includes intervention characteristics, outcomes, and cultural considerations in an effort to guide future research, practice, and policy at a time of increased digital education provision coupled with new attention given to educational equity. (UNESCO, 2022)

Method

The purpose of conducting a narrative review in this study was to synthesize and provide an interpretation of prior research regarding educational psychology-informed digital phonics interventions for the promotion of early literacy skills among Indigenous preschoolers. A systematic but flexible approach was used to obtain all types of research relevant to this issue, both theoretically based and empirically based and applied research. (Graham et al., 2023). Electronic database searching of four major electronic databases were used to locate research relevant to this study: Scopus, Web of Science, ERIC, and Google Scholar. Use of these four databases allows for a wide range of disciplines within education, psychology, Indigenous studies and educational technology to be represented. Additionally, hand searches of the references listed in each of the relevant articles and reviews were conducted to locate additional studies that may have been missed by the electronic database searches. (Yelland & Gilbert, 2023)

Search terms were developed in an iterative manner and were combined using Boolean operators to ensure a comprehensive yet targeted search strategy. Search terms included: digital phonics, phonics instruction, early literacy, educational psychology, Indigenous children,

preschool, early childhood and technology-based intervention. Related and variant search terms (e.g., phonological awareness, computer-assisted literacy, Aboriginal and First Nations) were also searched as part of the broader search strategy.

The search was limited to peer reviewed research written in the English language and primarily published between 2020 and 2026. Studies focusing on preschool aged Indigenous children (approximately 3–5 years) examining phonics or phonological aspects of early literacy and incorporating a digital/technology mediated component of their intervention were included in the search. Research based on educational psychology theories were included regardless of whether they were empirical or conceptual and theoretical in nature. (Anthony & Francis, 2023)

Exclusion criteria included research studies focused exclusively on non-Indigenous populations, research studies that did not utilize digital/technology mediated approaches to teaching phonics, research studies focused on individuals who are over the age of five years, or research studies that reported outcomes unrelated to early literacy. This inclusion or exclusion criteria allowed for a balance of engaging critically with a variety of forms of evidence and avoided overly restrictive selection criteria which would potentially result in excluding contextually important information. (UNESCO, 2022)

Discussion

Synthesis Analysis

1. **Conceptualising Digital Phonics Interventions in Indigenous Early Childhood Contexts**
Throughout the literature, a common definition of digital phonics interventions are “technology-delivered programs that teach letter sound correspondence, decoding and phonological awareness in multimedia-rich, interactive formats.” In terms of educational psychology, these interventions are often based on cognitive and constructivist theories that focus on scaffolding, repetition, immediate feedback, and learner interaction (Mayer, 2020). Different studies make differing degrees of explicit or implicit reference to Indigenous epistemologies and multilingual language contexts. In addition to these contradictory perspectives, some authors conceptualize digital phonics as neutral technologies and therefore could be applied in all educational contexts, while others claim that those interventions are based on Western literacy standards and embody potential culturally mismatch and linguistic assimilation. This is a tension that plays out the unresolved conflict between whether digital phonics should comply with standardised models of skill acquisition or reconceptualise itself in terms of culturally responsive pedagogies (Nakata et al., 2020; Bishop et al., 2022).
2. **Fundamentals of Educational Psychology and Learning**
Phonological awareness and decoding are consistently identified as core cognitive precursors of early reading success in the reviewed literature, thus supporting the theoretical underpinning of phonics instruction (Anthony & Francis, 2023). It is claimed that digital formats also improve these processes, by adaptive difficulty levels, and multimodal input as well as motivational affordances such as gamification (Hirsh-Pasek et al., 2020). However, there are conflicting results about the depth of learning achieved: improvement in letter–sound knowledge is reported in some studies, but others cast doubt on the transferability of digital skills to real reading (Arrow et al., 2021). A paucity of research operationalising motivational theories, self-regulation or social learning (all key

constructs in educational psychology) to the cultural learning styles of Indigenous children suggests a disconnect between theory and culturally situated practice (Parsons & Taylor, 2022).

3. Cultural Responsiveness and Contextual Relevance

One of label in literature is Digital Phonics and it's culture appropriateness. While it is widely accepted that culturally responsive design increases engagement, adoption varies (Gillanders et al., 2021). Some of the interventions involve Indigenous images, stories or first-language supports and demonstrate higher levels of learner participation. In contrast, most commercially available programs are devoid of cultural adaptation thereby reinforcing deficit views of Indigenous learners (Phillips & Whatman, 2021; Flear & Ridgway, 2022). There is a pattern apparent in the literature of surface-level cultural inclusion rather than meaningful incorporation of Indigenous ways of knowing that continues to confront researchers and game developers.

4. Effectiveness, Limitations, and Equity Considerations

Evidence regarding effectiveness is mixed. There is much rhetoric about the short-term gains in phonics-related skills, but questions remain around lifetime reading and sustainability (Graham et al., 2023). Structural barriers such as lack of digital infrastructure, teacher training and community engagement are consistently cited as constraints (UNESCO, 2022). These constraints carry equity implications, namely that digital phonics is not able to solve systemic injustices without broader policy and pedagogical infrastructure.

5. Practice, Policy, and Research Implications

The overall evidence base in the literature indicates that digital phonics interventions offer promise if informed by educational psychology and delivered within culturally relevant pedagogy (Yelland & Gilbert, 2023). Research should further focus on Indigenous-led design, longitudinal outcomes, and the connection with social- and cultural-based learning (Bishop et al., 2022). For policy, and practice, the synthesis highlights the importance of considering digital phonics as one part of a full early literacy approach rather than an isolated solution (OECD, 2023).

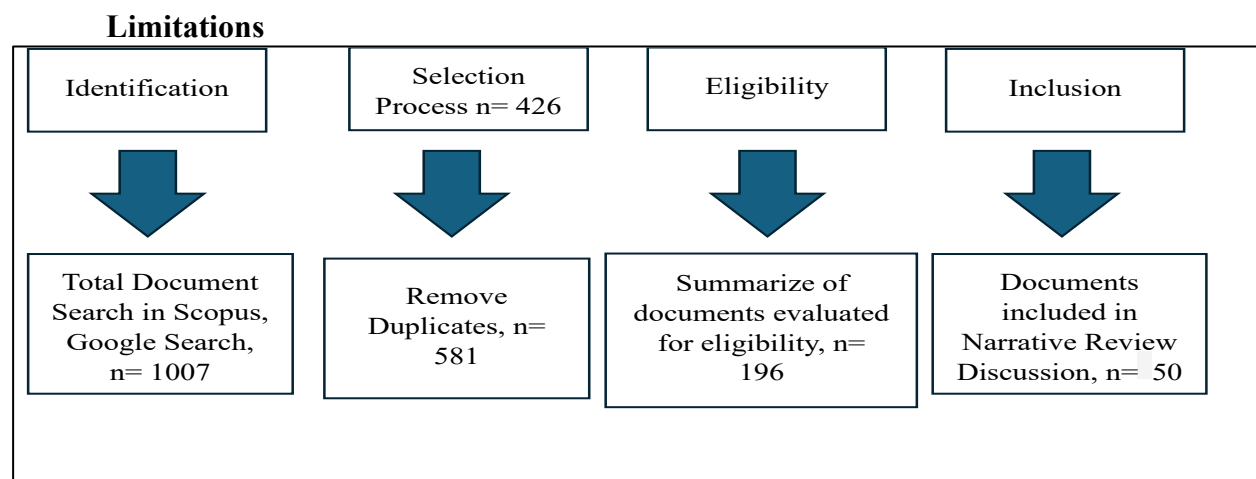


Figure 1: PRISMA-based Flow Diagram of Document Selection Process for Narrative Review

A total of eight individual search strings were utilised to encompass all areas of core theory, intervention effectiveness, cultural considerations and technology integration, as well as issues surround implementation (Graham et al., 2023).

This narrative review has several limitations to be acknowledged when interpreting our findings. First, as a narrative review, the methodology is not based on a complete systematic or replicable procedure. Despite the use of multiple databases and reference list searches, the search was constrained in all cases by scope and evolving. This raises the question whether potentially relevant studies such as unpublished reports, evaluations led by community based organizations or grey literature were not identified. Because research in Indigenous education is disseminated not only in high-impact academic journals, the evidence base may have been limited (Yelland & Gilbert, 2023).

Second, the available empirical data is scant and uneven. A number of other studies exploring digital phonics' interventions on Indigenous preschoolers feature small sample sizes, limited intervention durations or quasi experimental designs. There is a lack of longitudinal evidence regarding the persistence of literacy outcomes, and it is difficult to draw firm conclusions about its longterm impact. Moreover, across studies there is great heterogeneity in intervention, outcomes, cultural 'fit' and implementation setting limiting comparability and generalisability of these findings. (Arrow et al., 2021).

Third, there are limitations to the existing literature at theoretical and cultural levels. A large body of research is informed by Western educational psychology structures, with less integration of Indigenous epistemologies, languages, and community-identified indicators of what constitutes literacy success. This verges on cultural bias towards impoverished comparisons with non-Indigenous groups. The synthesis could therefore unintentionally reflect more widespread theoretical assumptions rather than a complete picture of Indigenous perspectives on early literacy and learning (Nakata et al., 2020).

Finally, as attends narrative methodologies generally, there are issues of the synthesis task and interpretive bias. The interpretation of results depends on the researcher's critical judgment, and weight is given to certain evidence or themes but this weighting/ prioritization can be subjective. Although attempts were made to provide the counterbalance view and acknowledge inconsistencies, alternative reading of same piece of evidence may exist.

These limitations could be remedied in future studies by utilizing mixed-methods and longitudinal methodologies, supporting Indigenous-led and community-engaged research, as well as using more explicitly transparent hybrid or systematic narrative review methods. Broadening the scope to include grey literature and Indigenous knowledge would also enhance the relevance, credibility, and equity of future reviews in this topic area. (UNESCO, 2022).

Conclusion

This narrative review explored the educational psychology underpinnings of digital phonics interventions for early childhood Indigenous preschoolers and aimed to synthesize theoretical bases, intervention components, efficacy, as well as cultural implications. The review indicates that digital phonics interventions using educational psychology principles, for example those of phonological development, scaffolding and learner motivation, can enhance the early literacy skill-set with a particular focus in letter sound knowledge and decoding. However, this synthesis also exposes serious limitations in the literature, including scarce incorporation of

Indigenous epistemologies, uneven cultural responsiveness and few strong longitudinal studies with evidence for sustained literacy outcomes. These results speak directly to the initial gaps in the research that was uncovered, as they show that digital phonics does have promise, but context and culture play a major role in determining its effectiveness, rather than technology per se.

Crucially, however, the review highlights continuing tensions between centralised phonics-based approaches and the community-embedded, strengths-based models of teaching and learning within Indigenous early childhood. In order to further the field, future research should focus on designing interventions that are led by Indigenous peoples in collaboration with communities, integrating multilingual and culture-based literacy models and employing mixed methods and longitudinal designs to capture both outcomes as well as the lived experiences. At a policy and practice level, digital phonics needs to be framed as an aspect of holistic early literacy provision underpinned by educator training, infrastructure investment and community engagement. Meeting these priorities will enhance the relevance, equity and sustainability of early literacy intervention for Indigenous preschool children.

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