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A Conceptual Framework for Emergent Digital Literacy

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Abstract As we progress in the 21st century, children learn to become proficient readers and writers of both digital and non-digital texts. Knowledge, skills, and understandings of literacy emerge through sociocultural interactions with non-digital tools (e.g., paper-printed books) and digital tools (e.g., touch screen tablets). However, debate is ongoing over the role that digital experiences play in emergent literacy development. Researchers have voiced the need to conceptualise a common framework for literacy development that considers the emergence of digital literacy skills alongside conventional literacy skills and how these skills might interact during development. This is particularly important in light of the increasing use of digital texts used by young children, such as E-books and digital games. Therefore, this paper proposes a framework that might guide research and practice by examining the relationships between emergent literacy skills, emergent digital literacy skills, and proficiency in reading and writing.

Keywords Emergent digital literacy · Emergent literacy · Digital texts · Non-digital texts · Literacy development · E-books

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Introduction

Debates have emerged over the role that digital texts play in emergent literacy development and these debates are complemented by the concern that traditional, well-established definitions of emergent literacy are too narrow and should be expanded to include emergent digital literacy skills (Burnett 2010; Floyd et al. 2008; Lankshear and Knobel 2003; Marsh 2004, 2005, 2006). Digital literacy refers to the use of digital tools to create meaning and communicate effectively with others, including the ability to use visual representations, integrate different digital texts, navigate non-linear digital texts, and evaluate digital information (Bulger et al. 2014; Eshet-Alkalai 2004; Ng 2012). The discussions surrounding digital literacy might reflect the limited research to date on identifying what early digital literacy skills are most important. Also, there is a lack of understanding about how digital literacy skills emerge and how these skills influence the development of reading both digital and non-digital texts to a proficient level. The need to address these issues has become more urgent due to the release of touch screen tablets (e.g., iPad) and the increasingly pervasive access to digital technologies contributing to the rise in pre-schooler experiences with digital texts at home and school (Livingstone et al. 2014; Neumann 2014; Northrop and Killeen 2013; Ofcom 2014). To illustrate, the use of E-books by young children at home and in early childhood settings is also increasing (Bus et al. 2015; Korat et al. 2013; Miller and Warschauer 2014).

Researchers and educators have called for a common conceptual framework of literacy development that can assist in understanding the acquisition of digital literacy skills (Burnett 2010; Floyd et al. 2008; Marsh 2004; Walsh et al. 2007). A reasonable starting point in such a framework is with children's interactions with digital texts

(Marsh 2006) and non-digital texts (Teale and Sulzby 1986). These interactions can be viewed from a sociocultural perspective whereby a child's experience with print begins with independent and scaffolded interactions in their environment (Neumann and Neumann 2014). Through experiences with cultural tools children make meaning, communicate, and develop a range of knowledge, skills, and understandings (Vygotsky 1978). Children's use of non-digital and digital text can be mediated by adults (Bus et al. 2015; Korat et al. 2013). However, computer-based tools also offer non-human mediation of learning through digital texts in the form of technical scaffolding (Yelland and Masters 2007). For example, E-books provide read alouds independent of an adult (de Jong and Bus 2002) and E-books can model fluent reading and guide children by linearly highlighting words as the text is narrated (Labbo and Kuhn 2000). A child's emerging understanding of print provides the pathway through which sociocultural interactions with text can lead to proficiency in conventional and digital literacy skills alike.

Developing a Framework for Emergent Digital Literacy

In response to the need for conceptualising emergent digital literacy skills to complement emergent literacy skills, a broad framework for digital literacy development is proposed and this is shown in Fig. 1. As already noted, sociocultural interactions with non-digital and digital texts will promote the development of emergent literacy and emergent digital literacy skills (Hisrich and Blanchard 2009; Kennedy et al. 2012). The dotted line surrounding the framework highlights the importance of viewing this model within a dynamic socio-cultural environment where parents, carers, teachers, peers, and evolving cultural tools (e.g., E-books, digital games, apps, and robotics coding software) play a key role in mediating children's experiences with text. The present framework aligns with Ber's (2007) *Positive Technology Development* model by highlighting the role computers play in supporting early social and cognitive development. The present framework recognises that children communicate and construct knowledge through both digital and non-digital experiences (Bers 2007, 2014).

Figure 1 frames digital and non-digital experiences with text as working together in parallel, interacting with each other, and thus are not mutually exclusive. The development of emergent literacy skills through early non-digital print experiences (Teale and Sulzby 1986) leads to proficient conventional literacy skills as described by established reading theories (Ehri 2005; Ehri and Roberts 2006). While emergent literacy skills have been identified and are well established, the proposed framework extends the scope of literacy development by conceptualising a parallel pathway of emergent digital literacy skills that lead to proficient digital literacy skills. As shown in the framework, important proposed relationships, transference, and overlap of knowledge through the use of both digital and non-digital tools potentially occur between emergent literacy, emergent digital literacy, proficient conventional literacy, and proficient digital literacy. A deeper understanding of these relationships can help guide the design of new emergent digital literacy measures and pedagogical strategies to help children become effective users of digital and non-digital texts. Elements of the framework will be discussed in the following sections.

Digital and Non-digital Texts

Children learn how to use signs and symbols to communicate through mediated interactions with cultural tools

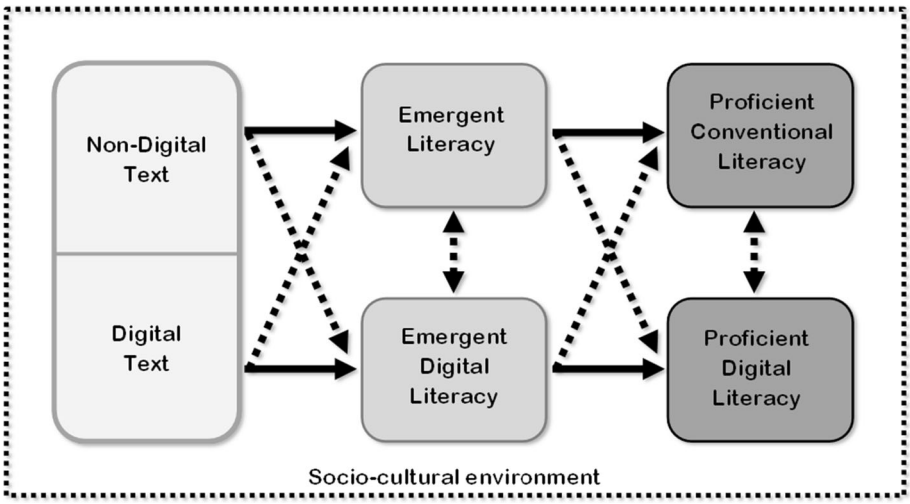

Fig. 1 A conceptual framework for emergent digital literacy development. The *solid arrows* indicate direct pathways of development in non-digital and digital domains and the *dotted arrows* indicate the overlap and transference of skills between non-digital and digital elements. The *dotted lines* surrounding the model represent that these interactions occur within a socio-cultural environment

(Vygotsky 1978). The tools can be used to convey meaning through their presentation of text, such as by using conventional alphabetic symbols (e.g., letters, words). Text may be presented in digital form (e.g., mobile phones, laptops, touch screen tablets) when generated by an electronic power source or in non-digital form (e.g., paper-printed books, road signs, product labels, pencil/paper) when it is not reliant on a power source. Despite their differences in origin, non-digital and digital texts have several common features. For example, the printed word 'dog' will be read as *dog* regardless of whether the text is in digital or non-digital form. Digital and non-digital texts are composed of alphabetic symbols that form words, sentences, and paragraphs and might appear in continuous forms (e.g., narratives, reports, journals, expositions, blogs) and non-continuous forms (e.g., icons, road signs, shopping lists, maps, recipes, tweets). Substantial overlap between skills for reading digital and non-digital texts may occur. E-books, for instance, are designed to have the same appearance as paper-printed books in terms of font type, colour, and layout.

However, there are also important differences between digital and non-digital texts. Digital texts have the potential to engage a wider range of senses than non-digital texts because their multimodal features can stimulate visual, auditory, kinaesthetic, and tactile senses. For example, multimodal digital texts (e.g., E-books, internet advertisements, web sites, digital games) can simultaneously integrate words, sounds, and images to arouse a variety of senses during meaning construction (Flewitt 2011; Marsh 2004, 2005, 2006; Walsh 2006). In addition, digital texts are dynamic and contain symbols unique to digital landscapes, allowing the reader to interact with texts in a variety of formats. Children may create their own reading pathways due to the non-linear nature of many digital texts through the selection of hyperlinks (Eshet-Alkalai 2004; Mendelovitis 2012; Walsh 2006; Winch et al. 2010). In digital game play, children may also experience a range of digital texts that they use to solve problems, design and explore new virtual worlds, and collaborate and communicate with each other (Gee 2012).

Although digital texts such as E-books have been found to promote children's early literacy skills such as print awareness, vocabulary, alphabet knowledge, and phonological awareness (Ihmeideh 2014), some research has shown there is no difference between using E-books or traditional printed books (Korat et al. 2013; Lauricella et al. 2014). This highlights the need for further investigation between the relationship between the use of E-books (an example of digital text) and emergent literacy as illustrated in Fig. 1. Furthermore, unlike non-digital text in traditional paper books, E-books may contain "seductive details" such as hot spots and games that distract children's attention from the text (Salmon 2013; Schugar et al. 2013). The reading aloud of traditional paper books has also been shown to be more beneficial to children's reading comprehension than E-books with distractive features (Krcmar and Cingel 2014). The quality and design of digital texts in E-books and how E-books are used to foster emergent literacy may be important factors in determining their contribution to emergent literacy development (Bus et al. 2015; Labbo and Kuhn 2000; Schugar et al. 2013). It is suggested that both traditional books and E-books be used to support children's early reading (de Jong and Bus 2002).

Emergent Literacy

Children's exposure to print begins early in life through a range of interactions with non-digital and digital texts and this leads to *emergent* skills used to construct meaning from these texts (Hillman and Marshall 2009; Hisrich and Blanchard 2009; Marsh 2004, 2006; Moody 2010; Thurlow 2009). Much is known about *emergent literacy skills* that arise through experiences with non-digital texts and the key importance of these skills for future reading and writing ability (Clay 1998; Justice et al. 2003; Teale and Sulzby 1986). Whitehurst and Lonigan (1998) define emergent literacy as "the skills, knowledge, and attitudes that are presumed to be the developmental precursors to conventional forms of reading and writing" (p. 849). Emergent literacy skills include letter name and sound knowledge, phonological awareness, print concepts, emergent letter and name writing, environmental print reading, and print motivation (Whitehurst and Lonigan 1998). The framework reflects this direct pathway among non-digital texts, emergent literacy, and proficient conventional literacy.

Emergent literacy theory aligns with the initial phases of Ehri's (2005) theory of reading development. Ehri's (2005) phases of reading begin early in life when children who possess little knowledge of the alphabet, logographically read words by using contextual cues such as the golden arches of the McDonald's sign (*pre-alphabetic phase*). As knowledge of letters and print emerges, children move into the *partial alphabetic phase* and are able to read simple words through the use of letter sound connections (e.g., initial and final letters). Following mastery of all letters, children enter the *full-alphabetic phase* with an increasing ability to decode words. This leads to the *consolidated phase* where orthographic and phonological skills are used and words are read fluently (Ehri and Roberts 2006). The development of emergent literacy skills paves the way for proficient conventional literacy skills such as word decoding, vocabulary, spelling, reading fluency, and comprehension (Sénéchal et al. 2001; Snow et al. 1998; Whitehurst and Lonigan 1998) and includes skills for code breaking, using texts, and being text participants and

analysts (Kennedy et al. 2012; Freebody and Luke 1990; Winch et al. 2010).

Emergent Digital Literacy

In contrast to the emergence of conventional literacy skills, less is known about the emergence of digital literacy skills in young children (Floyd et al. 2008; Kennedy et al. 2012; Marsh 2006). In alignment with the traditional definition of emergent literacy (Whitehurst and Lonigan 1998) and for the purpose of the proposed framework, *emergent digital literacy skills* will be defined as *the skills, knowledge, and attitudes that are presumed to be the developmental precursors of proficient digital literacy skills*. To further clarify this definition, proficient digital literacy refers to the use of digital texts and tools to access, manage, create information, and communicate effectively with others (Bulger et al. 2014; Ng 2012). Proficient digital literacy includes the ability to use visual representations, integrate different forms of digital texts, successfully navigate through non-linear digital texts, and critically evaluate digital information (Eshet-Alkalai 2004; Ng 2012). Skills involved in critically evaluating and analysing digital texts encompass searching, selecting appropriate software programs to fulfil a specific task, and identifying erroneous, irrelevant, or biased information (Eshet-Alkalai 2004; Ng 2012).

Research has begun to identify specific examples of emergent digital literacy skills that may be precursors to the development of proficient digital literacy skills. For example, Javorsky (2014) developed a *Digital Print Concepts* assessment, which was adapted from Clay's (2005) *Concepts about Print Test* with paper-printed story books. The Digital Print Concepts assessment measures emerging digital literacy skills required to read a story on an iPad. For example, children were asked to show the front of the iPad; how to turn on the iPad; which icon shows a picture of a letter/word; and how to advance the page. Javorsky (2014) administered the Digital Print Concepts test using an iPad to 122 kindergarten children and found it useful for assessing knowledge of sign systems and operation, navigation, and interactivity skills in emergent readers. However, Javorsky (2014) suggested that more research on emergent digital measures is needed with a greater age range of children, and that longitudinal analysis is required. In addition, future work should be careful not to limit the measurement of emergent skills using a single device or control method given the large diversity of digital tools. This approach will enable a more accurate understanding of digital print concepts in children.

Other types of children's emergent digital literacy behaviours that have been observed in pre-school and home settings include icon identification, digital navigation (e.g., use of menu buttons), key identification when typing on a pop-up keyboard, technical operation of devices, knowledge of digital terminology, user control methods (click, swipe, tap, home, scrolling), storage and retrieval, and hyperlink use (Beschorner and Hutchison 2013; Krcmar and Cingel 2014; Marsh 2006; Merchant 2005; Walsh 2006; Winch et al. 2010). This is not an exhaustive list, and it is essential that these skills, and others yet to be identified, be more fully defined and that valid measures of them are developed. Clearer identification of emergent digital literacy skills will enable researchers to determine the types of relationships these skills have with emergent literacy skills, proficient conventional literacy skills, and proficient digital literacy skills, as well as determining the transference and overlap of literacy knowledge that occurs during the use of digital and non-digital texts.

Due to the similarities between digital and non-digital texts, children's interactions with digital texts can promote emergent literacy development (Ihmeideh 2014; Salmon 2013; Whitehurst and Lonigan 1998). Similarly, interactions with non-digital texts may promote emergent digital literacy development such as aspects of digital print concepts (Javorsky 2014). Children learn to read logos and icons in digital (Javorsky 2014; Levy 2009) and non-digital contexts (Neumann et al. 2011) with possible transference of this knowledge between digital and non-digital tools (e.g., Facebook icon on an iPad screen and roadside billboard sign). This pathway is consistent with Ehri's (2005) pre-alphabetic stage.

The alphabetic system of letters and words are present in digital texts and non-digital texts and children will begin to recognise and read simple words in both contexts (Lankshear and Knobel 2003; Levy 2009), consistent with Ehri's (2005) partial alphabetic stage. Emergent literacy and emergent digital literacy development may interact, such that improvements in one domain may promote development in the other. Levy (2009) describes how pre-school children attempted to use phonetic decoding strategies to read text in paper-printed books and on computer screens. For example, one child explained "Books have certain words, and computer words are a little bit hard and sometimes you have to sound them out" (Levy 2009, p. 88). This illustrates potential transference of print reading strategies and knowledge between digital and non-digital tools. Levy (2009) highlights the importance of providing children with a range of opportunities and strategies to make sense of digital and non-digital texts.

The following example further illustrates the potential interaction between emergent literacy and emergent digital literacy. The home screen of a tablet computer will typically show an icon (e.g., FaceTime) with the name of the application (app) printed underneath it. A child may initially logographically "read" the icon name by recognition

of the FaceTime picture of a video camera rather than by the printed word. As their literacy skills emerge they will begin to use decoding skills to read the word under the icon. The pairing of the icon with the text may assist in the acquisition of their decoding skills for that word. In turn, the child may recognise the same word (or letters) when it appears in a different context in non-digital form, such as in a paper-printed book. Although this pathway is speculative and in need of verification, prior research using eye tracker technology has shown that as children's print knowledge increases they begin to pay more attention to the printed words embedded in logos (Neumann et al. 2015).

Proficient Conventional Literacy

For the purpose of the proposed framework proficient conventional literacy refers to proficiency in the reading and writing of non-digital texts. The term "conventional" is used here to distinguish it from "digital" literacy. There is a unidirectional pathway from emergent literacy skills to proficient conventional literacy. Prior to being literacy proficient, emergent literacy skills (e.g., alphabet knowledge) need to be mastered (Ehri 2005; Whitehurst and Lonigan 1998). Emergent literacy skills are assessed through validated and standardised measures (Otto 2008; Wright 2010) and have been found to be strongly predictive of proficient conventional literacy skills (e.g., ability to read fluently, comprehend, search, and use complex continuous and non-continuous non-digital texts; Sénéchal et al. 2001; Snow et al. 1998).

There is also a potential link between emergent digital literacy and proficient conventional literacy skills. Plowman et al.'s (2011) examination of children's use of computers at home showed that children's acquisition of early digital literacy skills (e.g., operation, information storage, and retrieval) supported the development of conventional print skills at school. However, further empirical work based on validated emergent digital literacy skill measures (e.g., digital print concepts, icon identification) is needed to investigate such a relationship.

Proficient Digital Literacy

The skills needed to be proficient in digital literacy are diverse and less clearly defined when compared with established and extensively researched conventional literacy skills. Ng (2012) defines being digitally literate as having "the ability to create meanings and communicate effectively with others through digital tools ……with the ability to search, assess, and synthesise from digital resources" (p. 1067). Eshet-Alkalai (2004) proposed five skill areas of digital literacy that users need to be competent readers and writers of digital texts. The classification of skills into these areas may guide the examination of key proficient digital literacy skills. *Photo-visual literacy* involves the ability to read visual representations (integrated images, words, sounds) of digital text, *reproduction literacy* involves the ability to create new information through the integration of fragments of different types of digital texts, *branching literacy* involves the ability to navigate efficiently through non-linear texts, *information literacy* involves the ability to critically evaluate digital information, and *socio-emotional literacy* involves the ability to effectively communicate with others using digital media.

Eshet-Alkalai (2004) argues that *socio-emotional literacy* is the most difficult digital literacy skill to acquire because users need to be mature in their approach to digital text and already display high competency in *information* and *branching* literacy. *Socio-emotional literacy* requires proficient sociological and emotional skills to effectively communicate when collaborating and sharing formal knowledge through online platforms, such as chat rooms and discussion boards, and through informal spaces, such as social media sites (Eshet-Alkali and Amichai-Hamburger 2004). Finally, Eshet-Alkali and Chajut (2009) proposed a sixth type of digital literacy referred to as *real-time thinking skill*s that involves the ability to process and evaluate high levels of digital information through, for example, digital games or online chat room experiences.

It is possible to see some links between these advanced digital literacy skills and emerging digital literacy. For example, emerging digital print concepts (Javorsky 2014), such as basic navigation and knowledge of icon functions may be predictive of non-linear hypertext navigation ability during online web-based research tasks. An exact measureable skill set that encompasses digital literacy proficiency requires deeper investigation (Eshet-Alkalai 2004; Walsh et al. 2007). In addition, by following the design of such measures of proficient digital literacy skills in parallel with longitudinal analysis, it will be possible to determine whether a positive and predictive relationship exists between emergent literacy skills and proficient digital literacy skills.

Walsh et al. (2007) have explored abilities required for reading online digital texts and have proposed a digital literacy framework of skills that complements Freebody and Luke's (1990) model of reading non-digital texts (code breaker, text user, text participant, text analyst). Walsh et al. (2007) identified digital literacy skills that primary school children needed to become proficient website readers. These skills included *coding skills* (decoding digital texts, operational skills such as scanning, scrolling), *semantic skills* (using search engines for research, applying inference skills, understanding functions of intertextual links), *pragmatic skills* (using hyperlinks, utilising Google definitions, creating digital texts such as PowerPoints), and *critical skills*

(analysing and evaluating online information, detecting bias, understanding author/audience text purpose).

A study reported by Bulger et al. (2014) highlighted further factors that may be important to consider when examining proficient digital literacy skills. The authors asked university students ($N = 150$) to write a research essay (using the internet and a word processor) that summarised online information about the use of laptops in classrooms. Students wrote their essays while their keystrokes, application usage, and online URL visits were monitored. Proficient digital literacy (measured by student's ability to write an essay by accessing, reading, and synthesising online sources) was predicted by academic experience (undergraduate or graduate) and knowledge about education topics. In contrast, technical knowledge (e.g., blogging, online social networking) did not predict digital literacy proficiency. The ability of students to organise and integrate digital information was positively correlated with digital literacy proficiency. Although the older age group of the sample limits the generalisation of the results, the findings suggest that the ability to use and synthesise digital information may be important precursor skills that underlie digital literacy proficiency.

Researchers have also explored the interactions and transference of literacy knowledge between non-digital and digital literacy activities in the primary school classroom such as through the dual use of digital and non-digital tools during a literacy activity. Simpson and Walsh (2014) describe how grade 5 children worked in pairs to hand write their persuasive drafts (radio advertisements) on paper before recording their non-digital text products on their iPads. The non-digital texts provided an explicit model for literacy learning and the iPads were used to create multimodal digital texts that fostered student collaboration. Although speculative, important relationships may exist between digital and non-digital literacy skills. It is possible that having to recall a letter, spell a word, and physically hand write it on paper (non-digital skill) may improve recognition memory when students use the pop-up keyboard functions on the iPad (digital skill). Walsh (2010) also describes a successful approach of engaging students with both digital texts (computer games) and non-digital texts (guidebooks, advertisements, trading cards) to motivate and engage grade 7 boys who struggled with their reading of non-digital texts.

The critical importance of developing frameworks that help to clarify the role that digital literacy and non-digital literacy skills play in the development of effective communication skills is further illustrated in Mendelovitis' (2012) report. Mendelovitis (2012) analysed PISA (Programme for International Student Assessment) assessment data of 15 year old Australian students' ability to read digital texts (critical ability to evaluate online information). Boys performed at a lower level than girls on the digital text assessment task with both boys and girls performing more poorly in non-digital text reading than digital text reading. This difference might have occurred because students were more motivated and competent in processing digital texts than non-digital texts (Mendelovitis 2012). This suggests that variations in motivation and engagement with digital and non-digital texts may be important factors to consider.

It is also important to note that the parallel design of the proposed framework does not imply that proficiency in conventional literacy and digital literacy skills arise at a similar rate. The emergence of both digital and non-digital literacy pathways is most likely influenced by the extent of experience children gain with these sociocultural tools. This would apply not only in the early years of life but also throughout the teen and adult years. Studies have clearly shown the important role that the home literacy environment plays in children's literacy development (Plowman et al. 2012, 2011; Purcell-Gates 1996; Sénéchal et al. 1998). Children who have limited access to digital tools at home or school may be delayed in the development of digital literacy skills (Levy 2009). In contrast, it is possible that children with limited experiences with non-digital literacy tools (e.g., paper-printed story books) but substantial experience with digital devices may reach specific aspects of digital literacy proficiency more quickly.

Conceptualising Emergent Digital Literacy and Directions for Future Research

Current curriculum documents are clear in their academic expectations that children need to become effective readers and writers of both digital and non-digital texts (Australian Government 2009; Australian Curriculum and Reporting Authority 2012; Kennedy et al. 2012). The proposed framework, informed by sociocultural theory, might help in conceptualising the role of digital tools in literacy development. As little empirical work exists to date on the emergence of digital literacy skills in young children (Merchant 2015; Neumann and Neumann 2015) the present discussion highlights key gaps in this knowledge. Neumann (2014) found a positive relationship between home access to touch screen tablets and letter sound and name writing skills. A more recent study showed a positive association between children's tablet writing at home and their print awareness, print knowledge, and sound knowledge (Neumann 2016). In contrast, quasi-experimental studies have found that tablets did not significantly enhance emergent literacy skills (Brown and Harmon 2013; Cubelic 2013).

Digital texts such as E-books have been shown to foster emergent literacy skills (Ihmeideh 2014). However, the benefits of E-books may be dependent on the quality of the

E-book (Schugar et al. 2013) and extent of adult mediation during E-book reading (Korat et al. 2011). Furthermore, little is known about the effects of E-books on emergent digital literacy skills (e.g., digital concepts about print; Javorsky 2014). The current state of research findings illustrates the need for randomised controlled studies to empirically investigate the effects of popular digital tools like touch screen tablets (Marsh et al. 2015) and apps (E-books, digital games; Neumann 2014) on both emergent literacy and emergent digital literacy skills.

Limited research has been conducted on the identification and definitions of emergent digital literacy skills and its predictive relationships with proficient digital literacy skills. These investigations might help determine whether there are truly unique digital literacy skills that differ from conventional literacy skills or whether they are just different manifestations of the same core skills. The transference of literacy knowledge that occurs between these factors during the meaning making process at various levels of development needs to be determined through longitudinal studies. In addition, new research methodologies, such as eye-tracker technology and screen play capture technology, is required to examine how young children's visual attention and interactions with digital texts in a variety of formats (e.g., app games, internet exploration) changes during development. Finally, further development of standardised measures of emergent digital literacy skills will help to fully evaluate the effects of digital texts on emerging reading and writing ability.

Conclusion

The proposed framework has been discussed with reference to relevant research to highlight the important role in which both non-digital and digital texts play in the development of literacy skills. The framework is deliberately broad enough so that it can be used by educators and researchers to view digital texts that are continually evolving in a socio-cultural environment and is subject to future technological developments and change. Such a framework may guide empirical research on understanding children's literacy learning through digital and non-digital tools in the home and early childhood education setting. Importantly, new knowledge in this field will enable parents and teachers to more effectively support young children's literacy learning.

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