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The advantages and disadvantages of digital books to children's emergent literacy.

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Abstract

The UK public and schools are spending millions of pounds on digital books every year. Touch screen devices and reading apps that host digital books might have been adopted by families without the parents necessarily considering the functional efficacy. This is potentially detrimental to children's development of emergent literacy; especially considering that children who are in this stage are more vulnerable to possible negative features of digital books, compared to children who are proficient readers. Shared reading of digital books within parent-child dyads, has shown associations with: greater story content being recalled by children, increased operational and vocabulary-related discourse, but reduced dialogic reading when compared to print books. Some digital books now come with an array of multimedia and interactive features with varying effects on emergent literacy. The review of the literature highlighted that multimedia features that are congruent to the story carried additive benefits for children compared to digital books more broadly. Interactive features, however, are not currently associated with any benefits so should be excluded from digital books designed to foster emergent literacy. Due to the attention and engagement interactive features can afford, future research should aim to find beneficial interactive features.

Digital books have been available for children to read since 1992, when the Living Books CD-ROM series were created (Liebeskind, 2015). Since then, the invention of numerous mobile electronic devices such as mobile phones, tablets, and e-readers, that can all host digital books, has meant the latter are now commonplace in both schools and homes. The Publishers Association (PA), in their 2018 Yearbook, reported that the digital book market stood at £394m in the United Kingdom (UK). This figure represents slightly under a fifth of the total sales of all books (i.e., including physical books) in the UK. Within the UK's digital book market total was £25m from the sale of digital books to schools and £10m from children's digital books bought by the public. Despite both amounts being relatively small percentages of the total

(the vast proportion resulting from adult fiction and academic/professional digital books), it demonstrates that school leaders and the public are willing to spend significant amounts of money on digital books. As well as various other types of digital books and online subscriptions, the PA's digital category also included audiobooks. The PA (2018) report that profits from audiobooks have risen 194% during the preceding five years due to accessibility afforded by smartphones, however the report does not further decompose this figure to allow for identification of audiobooks bought for children or schools. Audiobooks, by their very nature, do not have a visual text, so, for the purpose of this essay they will not be included in the term digital books.

Instead, the term digital book will be used to refer to any piece of technology that presents a narrative via text that is displayed on a touchscreen (Kucirkova, 2019) usually with multimedia features or interactive features. Multimedia features are additional visual or auditory information that automatically plays and coincides with the text being read (Richter and Courage, 2017). Additional visual information includes animation or video, and additional auditory information includes sound effects, music and audio narrative, hereby termed voiceover. Interactive features are those that require, at the very minimum, activation via a screen tap (Takacs, Swart, & Bus, 2015) to present additional information, options, experiences, or games. Accordingly, studies that have used e-books, story apps, picture book apps, and iBooks on a variety of touchscreen technologies are included within this definition.

Why and how have digital books ended up being adopted by some families with children? Kucirkova (2019) explains that the use of digital media is becoming more common in children's lives from an early age. Furthermore, Stringer, Lewin, and Coleman (2019) explicate, "New technology can often appear exciting" (p. 4).

One potential route of digital books into children's lives could be via the *adoption of hyped technology*; this is a model of consumer adoption identified and described by Hedman and Gimpel (2010). From their qualitative study based on participants' use of the iPhone in the first six months after its release in November 2007, Hedman and Gimpel (2010) suggested that new technology can be surrounded by so much extravagant publicity that the product becomes hyped, leading to potential discrepancies between the new technology's capabilities and consumer expectations. In their study, Hedman and Gimpel (2010), used the theory of consumption values (TCV), which Sheth, Newman, and Gross (1991) conceptualised to explain consumer behaviour. Within the TCV (Sheth et al., 1991) are five main values: functional (the effectiveness of the item potentially being bought at accomplishing the consumer's requirements), social (the conveyed image the item symbolises in society), epistemic (the consumer's urge to gain new knowledge about the item), emotional (the consumer's belief that the item will evoke desired emotions, or in some cases does so before purchasing) and conditional (the consumer's belief as to the item's worth when given a distinct situation). Following coding and analysis of iterative data collection from interviews and focus groups, Hedman and Gimple (2010) found that epistemic, social, and emotional values influenced the adoption of the hyped technology, whereas conditional and functional values did not. If functional value does not influence the uptake of hyped technology, then there could be a

potential risk that the purchaser does not consider the effectiveness of the technology. Therefore, parents might not consider the efficacy of children's digital books hosted on their touchscreen device.

As well as the above reasons for digital books being present in children's lives, there is a further contributing factor: there are widely accepted benefits of adults reading printed storybooks to children (Kucirkova, 2019). Hamilton (2014) found that for their typically developing group of 4-year-old children, storybook exposure was significantly associated with concurrent oral language ability, phoneme awareness and letter knowledge. Picton (2017), from reviewing studies that looked at the long-term outcomes of shared early reading of print books, explained that the process fosters both positive reading attitudes and pleasurable experiences which lead to later improvements, not only in reading competency and comprehension but also language. Reese, Sparks and Leyva (2010) highlighted that the first teachers of children are their parents, so it is clearly important to explore and highlight to parents the best ways in which the potential power of digital books can be harnessed to improve children's emergent literacy development.

When Jones and Brown (2011) compared the effects of reading e-books and traditional print-based books on comprehension, enjoyment, and engagement in third-grade (equivalent to year 4 in the UK) students, they found no significant difference between the two book formats. Compared to older children who have learnt how to read, Bates et al. (2017) describe how beginner readers find the changeover to digital books more difficult. Digital books offer a greater number of features than print books, so therefore have the potential to exert greater influence on children who are still in the emergent literacy stage (Bates et al., 2017). This essay will therefore focus on children who are in the emergent literacy stage.

Children's emergent literacy skills were described by Neumann (2016) as, "Print awareness, print knowledge, [and] sound knowledge' (p. 62). Rohde (2015), in a comprehensive emergent literacy model, explained that the skills required for emergent literacy can: be referred to as emergent literacy, typically develop between birth and age five, and include "knowledge and abilities related to the alphabet, phonological awareness, symbolic representation and communication" (Rohde, 2015, p. 1).

In consideration of the potential risk of hyped technology (Hedman & Gimpel, 2010), the fact that digital books can be part of children's lives from an early age and the well-documented influence of reading on helping to develop children's emergent literacy skills, an important question arises which this essay will attempt to address. What are the potential advantages, limits, and if any, disadvantages to children's emergent literacy, when digital books are used instead of print books? If pitfalls are present, what could parents do to minimise these to make time spent reading digital books advantageous to the child's emergent literacy?

The advantages and disadvantages of reading digital books versus print books to children in the emergent literacy stage will be examined. Next, studies that consider the associations with, and outcomes of, using digital and print books, read with children in the emergent literacy stage, and under different conditions including shared reading with parents, will be discussed.

Potential ways in which to counteract any disadvantages will be considered. Findings from the essay will be summarised with reference to a meta-analysis of the benefits and pitfalls of multimedia and interactive features in digital books (Takacs et al., 2015). By emphasising the most and least effective features of digital books and effective conditions under which they are read, possible wider applications and future research will then be addressed.

As Kucirkova (2019) explains, ever since digital books have been compared with print books, both positive and negative effects have been observed on children's emergent literacy skills. For example, two recent studies by Altun (2018) and Richter and Courage (2017) compared the effects of digital books and print books on comprehension and found different results. These two studies will be considered in more detail before turning to a further study by Dore et al. (2018), which again focused on comprehension as an outcome, but instead used only digital books and varied the method of delivery.

Altun (2018) investigated how effective digital books were at improving comprehension skills in 5-year-old children and chose to distinguish between explicit story comprehension (ESC) and implicit story comprehension (ISC). ESC concerns the identification of overt story elements (e.g., information about characters or setting) whereas ISC involves interpretation and a deeper understanding of the story (e.g., making predictions). Altun's (2018) experimental group watched and listened to digital stories presented via an iPad, whereas the control group listened to the same stories being read from a book by an adult. Apart from the experimental group listening to a recorded human voice compared to the human reading to the control group, the main difference between the two groups was the multimedia enhancements present for the experimental group. The experimental group saw a greater number of images, some of which moved, together with background music and sound effects. The experimental group was prevented from using the digital book's interactive hotspots because of Altun's (2018) acceptance that hotspots hinder comprehension (Takacs, Swart, & Bus, 2015). Altun (2018) found that both types of story comprehension were positively affected by the digital books, however more so for ESC than the more demanding ISC. Altun (2018) suggested that it is the multimedia enhancements within digital books that foster ISC.

Previously, when Richter and Courage (2017) assessed the ability of 3-, 4-, and 5-year-old preschoolers to recall the stories that they had heard being read from digital and print books (via voiceover, and an unknown adult, respectively), they also included inference type questions similar to those used by Altun (2018). During the digital book condition, as well as multimedia features that included visual animation sound effects and background music, Richter and Courage's (2017) participants could use the interactive features that, in this study, simply replayed the multimedia features or repeated certain words. Unlike Altun (2018), Richter and Courage (2017) found that there was no effect of book format on the ability of their participants to recall the story content. Richter and Courage (2017) did find however that there was supposedly more engagement and attentiveness from the children towards the digital book, but that the children communicated more about the actual iPad compared to the amount they spoke about the story during the print condition. The equivalence in story recall between the two formats used by Richter and Courage (2017), suggested that the

increased engagement and attentiveness shown to digital books might not have been directed to the story information; rather, the increased engagement and attentiveness could have been due to the interactive features.

When Dore et al. (2018) compared pre-readers' (4- and 5-year-old children) comprehension of digital books, they chose to vary the method of digital story delivery. In all conditions the children could always see the story presented on the iPad's screen, but it was either: read by a parent, 'read' by the child themselves, or a voiceover was used. Due to it being a fifth-grade (equivalent to year 6 in the UK) reading level book, Dore et al. (2018) presupposed the children could not read it but acknowledged that not formally assessing the children's reading ability was a limitation of their study. Dore et al. (2018) found that digital book reading by a parent to the child was associated with the most content information being recalled by the child. Compared to parental reading, voiceover lead to less content being recalled, but more so than the child reading alone (i.e., with no audio narration). The authors concluded that digital books with voiceover could be used if there is no adult available to read; however, to support the development of children's comprehension, meaningful adult interaction should take preference.

During Dore et al.'s (2018) parental reading condition, "The researcher waited in an adjacent room" (p. 27), so despite asking parents to read as they would normally do so at home, the authors unfortunately had no direct observational data concerning the reading strategies of the parents. Furthermore, due to parents possibly wanting their child to succeed in the experiment, the parents might have attempted to improve their reading style; for example, they might have increased the amount of *dialogic reading*. Dialogic reading is where two people (in this essay, an adult and child) who are reading a book together, engage in dialogue and questioning that deepens understanding, defines definitions, and analyses story components (Iturbe, 2019).

The reading strategies used by parents during the emergent literacy stage are an important factor in children's engagement with, and outcomes of, reading both digital and print books (Kucirkova, 2019), so will now be explored further.

Even before the advent of iPhones and then tablets, research had started to be carried out on the parent-child shared reading with print and digital books, often finding a reduction in verbal interactions when digital books were used. For example, a case study carried out by Kim and Anderson (2008) looked at the differences in a mother's interactions with her 3-year-old (and 7-year old) when shared reading took place with either print books, or digital books presented via video clip format or CD_ROM format that afforded greater interactivity. Kim and Anderson (2008) found that for the 3-year-old, there were a greater number of interactions initiated by both the mother and child within the print book condition compared to both digital book conditions. Similarly, Korat and Or (2010) found that mothers who were randomly assigned to a print book reading condition showed more verbal initiations and responses with their kindergarten children compared to those mothers assigned to reading digital books.

As time has progressed, research has started to look more at the specific types of interaction between parents and children during the shared reading process of digital versus print books.

MacKay (2016) categorised verbal and behavioural interactions in mother-child dyads and found that vocabulary-related interactions and child engagement increased when reading digital books, but text and print related interactions decreased. Interactions concerning the operational aspects of using a digital book increased. Whilst Mackay (2016) points out the usefulness of the latter in improving children's digital literacy development, it could be assumed that increased operational conversations for the digital book condition might have come at the expense of other shared reading benefits. Indeed, Mackay (2016) found that during the digital book condition the mother and child showed less sensitivity to each other, for example by looking at each other less.

The research by Kim and Anderson (2008), Korat and Or (2010), and Mackay (2016), suggests that when parents read digital books with their children, a reduction in the amount of dialogic reading occurs, possibly due to the interactive features or the digital book's auto-narration (if present) competing with parent discourse (Revelle & Bowman, 2017). In a study designed to test if observed reduction in dialogic reading was due to either interactive features and/or auto-narration (no distinction between the two was attempted), Revelle and Bowman (2017) compared conversations that took place in the parent-child dyad when reading either a print book or a digital book that was completely absent of multimedia and interactive features. Despite the absence of features, a reduction in dialogic reading still occurred for their digital book compared to the print book. So regardless of digital book interactive features, the mere act of presenting a book via a screen, Revelle and Bowman (2017) said, led to parent-child interactions in the digital book condition being negatively affected. However, the fact that Revelle and Bowman (2017) used different books between the two conditions raises doubts over their conclusion. The digital books were all 'Sesame Street' books whereas the print books were a variety of traditional stories. Participants may have been more interested in the latter, which could have been the reason for more dialogic reading occurring for print books. Furthermore, the size of the screen used (on a Nokia smart phone) to present the digital book, was markedly smaller than an average-sized children's print book; this could have been yet another possible reason for greater dialogic conversation to occur for print books namely because the participants could see it in more detail. It could be argued, therefore, that the previous findings of reduced dialogic reading during digital book conditions (Kim & Anderson, 2008; Korat & Or, 2010; Mackay, 2016) are still associated with the interactive features.

A more recent study by Munzer, Miller, Weeks, Kaciroti and Radesky (2019) examined verbal and nonverbal interactions between parents and toddlers (24 – 36 months old) whilst parents read either digital or print books. Munzer et al. (2019) found that collaborative book reading, and dialogic parent verbalization, were significantly lower for digital books than print books. Munzer et al. (2019) explained how dialogic reading practices have previously and frequently been shown to encourage the development of children's expressive language and engagement. Therefore, their finding of decreased quantity and quality of dialogic reading practices for digital books is suggestive that the use of digital books, for parent-toddler shared reading at least, should be discouraged. Indeed, Munzer et al. (2019) even go so far as to suggest that "paediatricians may wish to recommend print books over electronic books with distracting features for parent toddler shared reading" (p. 8).

In their specific recommendation to paediatricians, it is interesting to note that Munzer et al. (2019) failed to highlight that in their study, parents and children displayed significantly more off-task verbalisation when reading print books compared to the 'enhanced' digital book; this contained audio-visual hot spots to trigger picture animations, sounds effects and specific word narration. The lack of off-task verbalisation for the digital books could have been considered an advantage, due to the increased attention that the digital book commanded. Munzer et al. (2019) instead suggest that the increased attention the digital book commanded, could have been at the expense of the beneficial collaborative book reading and dialogic reading practice. Unfortunately, Munzer et al. (2019) did not measure whether the supposed increased attention to their enhanced digital book led to an improvement in a learning outcome. Neither did they mention that previously, Strouse and Ganea (2017) found such an improvement in the learning outcome of toddlers (17 – 26 months old) when the parent-toddler dyad had been randomly assigned to a digital book condition.

In their study that investigated parent and toddler behaviour and language during shared reading of digital or print books, Strouse and Ganea (2017) found that between digital and print book conditions, behavioural talk and off-topic talk for children and parents showed no difference. The toddlers who were read digital books as opposed to print books, showed, in agreement with Munzer et al. (2019), greater attention towards the book. The toddlers in Strouse and Ganea's (2017) study also showed more availability for reading and made more content-related comments. Furthermore, after the reading took place, Strouse and Ganea (2017) subsequently included a test of the toddlers' learning and found that the digital book condition led to more correct choices, which was indicative of greater learning taking place.

Strouse and Ganea (2017) explained that one potential reason for finding this positive effect of digital books, was that their toddlers were younger relative to other studies and that the digital books they used may have been simpler in that they did not contain any hotspots. Instead Strouse and Ganea (2017) suggested that their digital books had "simple animations and sound effects… well-enough aligned with the content to direct children and parent's focus on the relevant content of the book" (p. 11). This highlights the importance therefore of digital books incorporating or having the option for multimedia features that are congruent with the story (Tackas et al., 2015).

This essay aimed to find out what the potential advantages, limits, and if any, disadvantages are to children's emergent literacy skills, when digital books are used instead of print books? Beginning with three recent studies involving digital books for at least one of their conditions, the effects on story comprehension were explored. Given certain experimental conditions and digital book properties, this essay showed that digital books could improve story comprehension for children in the emergent literacy stage. This agrees with findings from a meta-analysis of 43 studies that compared "the effects of technology-enhanced narrative stories to more traditional presentations on young children's language and literacy development" (Tackas et al., 2015, p. 702). Digital stories with multimedia elements present, proved to have a significant positive effect on both story comprehension and expressive vocabulary compared to more traditional presentations (Tackas et al., 2015).

The essay then considered studies that looked at the differences of parents reading digital books or print books with their children in the emergent literacy stage. Mothers reading digital books were associated with more story content being recalled than a voiceover condition (Dore et al., 2018). Digital books, when compared with print books, were associated with increases in child engagement and operational and vocabulary-related discourse in the parent-child dyads (Mackay, 2016). However, research also presented findings of a reduction in the amount of dialogic reading when using digital books rather than print books (Kim & Anderson, 2008; Korat and Or, 2010; Mackay, 2016).

Munzer et al.'s (2019) study that warned explicitly of the reduction in quantity and quality of parent-child dialogic reading practices when using digital books, did not sufficiently highlight the significant off-task verbalisation when reading print books compared to digital books. It was then put forward that digital books could afford greater attention and therefore potentially be beneficial to children's learning. Indeed, Strouse and Ganea (2017) found that digital books with congruent multimedia features could positively affect a learning outcome in toddlers.

Interactive features such as hotspots were discussed in some of the research presented in this essay (Altun, 2018; Munzer et al., 2019; Revelle & Bowman, 2017; Richter & Courage, 2017) and found that children's attention and engagement were often drawn away from the story by these features. Due to interactive features being involved in so many different types of studies, it is useful to use the aforementioned meta-analysis (Tackas et al., 2015) to decipher as far as possible the advantages or disadvantages of digital book interactive features. Tackas et al. (2015) found that interactive features "negatively affected story comprehension and expressive word learning" (p. 729). Regardless of the relevance to the narrative, Tackas et al. (2015) suggested interactive features distract attention and, although not explored in this essay, interactive features were shown to distract disadvantaged children to an even greater extent. Therefore, it seems that interactive features are indeed pitfalls to digital books, so in the context of emergent literacy, these should seemingly be avoided. Multimedia effects however were found to be beneficial on many levels so should remain a desired feature of current digital books and be required in future digital book design.

Even though interactive features have seemingly failed to foster and develop emergent literacy in typically developing children, it would be beneficial to find a type of interactive feature that does improve emergent literacy outcomes. If an effective interactive feature was found, the increased attention and engagement that they already afford (Tackas et al., 2015), could lead to further improvements in emergent literacy.

As Dore et al. (2018) highlight, a great amount of digital book research has been carried out in the USA, so it would be advantageous to include more international research in this field. It would also be beneficial to the field of digital book research, and future generations of children, to design studies now that spanned greater time frames to enable longer-term outcomes and general efficacy of digital books to be more accurately measured. This will hopefully maintain the fine tuning of digital book design so that their continued use by children will be as beneficial as possible.

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