How Technology has Changed the Way We Read
And what this means for emergent readers

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Right now, many of you are reading this article while sitting in front of your computer or tablet. Some of you may have found the "printer friendly version" icon and are reading a paper version. Share your preference for paper or screen reading by taking out poll:

> I prefer to read:
> - □ On a screen (computer, tablet, etc)
> - □ On paper (printed document, book, etc)
> - □ Both

Now think about this for a moment: Will the "screen readers" understand and remember as much of this article as the "paper readers"?

I took a look at current research to see if there was an answer to this question. Then I read what experts had to say about the potential impact of digital reading on young, emergent readers, whose first foray into reading would likely involve both paper and screens. Read on to see what I discovered.

How do we read on screens?

We live in a screen-saturated society, and this has had an impact on our reading behaviour. According to Liu (2003), "Whether people like digital media or not, reading and literacy are being redefined by the arrival of digital technology" (p. 701). Liu surveyed 113 individuals with extensive experience in reading digital documents, inquiring about how their reading habits had changed from 1993-2003. He found these patterns:

New reading habits (Liu, 2005)

- **People are spending more time reading nowadays**, especially on digital media
- **Many people print out electronic documents** – nearly 90% of participants preferred reading on paper over digital media. Many people printed documents for in-depth reading and annotating
- **Screen-based reading behaviours have emerged**, which include scanning, browsing, keyword spotting, one-time reading and reading more selectively

> **A note about terminology**
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> *There are many terms used to describe screens that display text as well as the act of reading on a screen, such as "digital literacy", "digital media" and "e-reading technology". In this article, I use the term "digital media" to refer to devices such as e-readers, tablets, smartphones, and computers that display digital text (Biancarosa & Griffiths, 2012).*

- **Non-linear reading has increased** – hypertexts (linked topics) allow readers to jump from topic to topic, but this also decreases sustained attention and distracts readers from thinking deeply about a single subject
- **Most people like to read the first screen of text only** and don't scroll down for more information
- **Less time is spent on in-depth, concentrated reading**

Some of these behaviours have been confirmed by studies using eye-tracking technology, that have observed an "F-shaped pattern" when reading online. People first read horizontally across the upper part of the content area (the top bar of the F), moving down a bit and reading across again (the lower bar of the F), and finally they scan the left side vertically (forming the stem of the F) (Nielson, 2006). This non-linear scanning allows readers to quickly grab the information they need. They also tend to avoid "walls of words" (Redish, 2007) and are drawn instead to lists, bullets, and short bits of information.

Do we learn as much when we read on screens?

With these new ways of reading, researchers have started to question whether we absorb as much from screens as we do from paper.

► Early studies: Paper is better

Studies prior to the early 1990s generally found that individuals demonstrated better performance on speed, accuracy, and comprehension with paper texts. However, reading comprehension varied in these studies according to the text length and structure, the reader's interest in the material, and whether the reading was for learning or entertainment (Porion, Aparicio, Megalakaki, Robert & Baccino, 2016).

Screen technology has advanced since the early 1990s, and more recent studies have compared paper texts to screen reading that is somewhat closer to the paper experience (Noyes & Garland, 2008).

► Some recent research shows no difference between paper and screens

Aiming to control for some of the above factors, Porion et al. (2016) devised a single page text which didn't require scrolling. They assessed 72 secondary school students' performance while reading this text on either a computer screen or paper. They looked at the students' ability to understand and remember the text, and whether they could link the text with information already in their memory. Results showed that the type of media did not affect their performance. The researchers attribute their results to improvements made in digital media in recent years, the younger age of their sample (these students were more familiar with digital reading than subjects in earlier studies), and the fact that they controlled for length of text.

Margolin, Driscoll, Toland & Little Kegler (2013) also found no significant differences in young adults' understanding when they read from either a computer screen, e-reader, or paper. Their 90 participants

read both expository and narrative texts and then answered multiple choice comprehension questions afterwards. However, the texts used in this study were relatively short (approximately 500 words).

► *Other recent research favours paper*

Mangen, Walgermo & Brønnick (2013) studied 72 tenth grade students' comprehension of an expository and a narrative text, but these texts were between 1400-2000 words (longer texts than in the above studies). The students read the texts as PDFs on a computer screen or in printed form. The authors found that the students who read the paper versions scored higher on post-reading reading comprehension tests.

In another study, Mangen, Robinet, Olivier & Velay (2014) asked fifty adults to read a short mystery story on either a Kindle (e-reader) or printed book. The adults who read the printed version showed stronger performance when asked to order story events chronologically. When questioned about their reading preference, most participants preferred paper over screens.

There are a couple of reasons individuals may perform better with paper than screens:

- paper provides spatio-temporal cues such as touching the paper and turning pages, and this allows readers to see and remember a passage in the context of the whole text (Myberg & Winberg, 2015; Jabr, 2013)

- longer texts which involve scrolling may require more cognitive resources as the reader has to focus on both the text content and how to maneuver it (Wästlund, Reinikka, Norlander & Archer, 2005).

Another study by Santana, Livingstone & Cho (2013) provided college students with either the print version or an online version of the New York Times, and asked them to remember as many headlines, topics, and main points as they could after 20 minutes of reading. The authors found that print readers remembered more news stories than online readers. They explain that the online readers may have scanned stories and print readers may have been more methodical. Also, there are fewer cues to orient online news readers to key daily headlines because online story placement and prominence are in a constant state of flux (Carroll, 2014).

Concerns about young, emergent readers

It's important to note that much of the research about screen versus paper reading has examined older students and adults who have achieved at least a basic level of literacy. But what about young, emergent readers? What impact will digital media have on their development? Hisrich & Blanchard (2009) point out that "these media are exerting a mostly unknown influence on emerging literacy skills." (p. 250).

Some researchers, such as Wolf, Ullman-Shade & Gottwald (2012), fear that digital reading may negatively impact our "reading circuit". They explain that while humans have a natural predisposition for oral language, reading requires time, effort, teaching and active modeling. Its mastery depends on a neural rearrangement of already existing, genetically programmed systems such as the visual and oral language systems. The neuroplasticity of our brains allows for new connections among these existing systems. The brain of each new reader continues to be rewired over time until a new reading circuit is formed.

Wolf et al (2012) question though, whether an immersion in digital reading will impact the development of our reading circuit, and alter our capacity to think deeply and reflectively while reading. Digital reading involves quick scanning and a continuous partial attention, while deep reading is slow, immersive, and contemplative. Wolf (2010) is concerned that:

> "…confronted with a digital glut of immediate information that requires and receives less and less intellectual effort, many new (and many older) readers will have neither the time nor the motivation to think through the possible layers of meaning in what they read" (p. 3).

And it's the children who are just beginning to develop reading skills that concern these authors the most. They explain:

> "Children in these phases of the development of their reading circuit need to learn how to focus and concentrate all their attention on text that is worthy of their sustained attention whether in print or screen mediums" (Wolf et al., 2012, p. 237).

Hoffman & Paciga (2014) voice another concern: the e-book can be used independently by emergent readers without adult-child interaction. But rather than replacing the need for an adult, Hoffman et al. (2014) suggest that e-books can offer a new form and context for the rich adult-child interactions that provide language and literacy scaffolding for emerging readers.

Ensuring emergent readers get off to a good start

The average child today spends nearly 45 hours per week with media, compared with 17 hours with their parents and 30 hours in school (Common Sense Media, 2008). This means that media is having a huge influence on children. While we don't yet know the full impact digital media will have on the next generation of readers, we do know key prerequisites that emergent readers need in order to acquire literacy skills, some of which include:

- **time** – while physical books provide children with a lot of time, digital media speeds up the pace (Konnikova, 2014). Hoffman et al. (2014) suggest we need to control the pace during shared reading with digital media to enable scaffolding and dialogue. Pausing and waiting can naturally slow things down for children.
- **back-and-forth conversation during shared reading** - in order to learn to read, children need to learn to think deeply and connect texts to their lives. This is promoted during adult-child conversations during shared reading experiences. While some digital media allow children to independently peruse texts, this shouldn't replace rich adult-child dialogue around texts.
- **story comprehension and critical thinking** – the message from experts concerned about today's young readers is that we need to develop their comprehension and critical thinking skills. Strategies from ABC and Beyond™ and I'm Ready!™ like CSPAR and the E's and P's promote deeper story understanding and critical thinking

    o *CSPAR* – children learn story framework and further their comprehension through discussions about the Characters, Setting, Problem, Actions, and Resolution
    o *E's and P's* – the ability to use language to think and learn is critical for literacy development and deeper thinking. This can be facilitated when caregivers use the E's (Explain, Experience, Emotions, and Evaluate) and P's (Predict, Problem-solve, Project, Pretend) during shared reading

- **scaffolding** - Margolin et al. (2013) suggest that caregivers "scaffold children's meaning-making efforts through language interactions that include comprehensible input, prompts for output,

connections to real life experiences, and repetition" (p. 386). Such scaffolding is critical for emergent literacy development, whether it occurs during shared reading of paper or electronic books.

Summary

Technology is here to stay. Even those concerned with the impact of technology on our deep reading skills can't deny the possibilities afforded by this new media. Our job is to ensure that young readers develop the skills they need to read, whether it be on a screen or on paper, and to support their caregivers in their attempts to build their children's literacy skills.

For further information about supporting children's emergent literacy, take a look at our two resources, ABC and Beyond™ (a guide for early childhood educators) and I'm Ready!™ (a guide for parents). Our article "Helping Emergent Readers in a Digital World" can be distributed to parents to help them support their child's emergent literacy skills while sharing digital media together.

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