



Does Medium Matter for Learning?

Reading in Print, Onscreen, and with Audio

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Consider Dana, a Typical Student ...



... Needing to Acquire Textbooks

- What are Dana's considerations
 - Cost
 - Buy (print or digital)? Rent? Borrow? Don't acquire?
 - Convenience
 - Interest in subject (and whether he plans to keep the books when course is over)
 - Heads-up: in the US, most students don't
 - School policies and practices
 - Beliefs about how he learns best
 - To be balanced with cost, convenience, interest, school policies and practices

Why Talk about Textbooks?

- Textbooks are major motivation for switch from print to digital in education
 - Historically and today, overwhelmingly driven by cost, not pedagogical evidence
- Leads to broader discussion of
 - Digital trends
 - Pedagogical trends
 - What the research on reading modality shows

Goals of Today's Talk

- Understand recent shifts in educational practice
- Review current research comparing
 - Print vs. digital reading (primary focus today)
 - Text vs. audio
- Summarize what we have learned
- Put discussion in larger educational context
- Suggestions for moving forward regarding medium and reading for learning

Caveats and Qualifiers

- United States vs. elsewhere
 - Digital statistics: specific to US
 - Textbook trends: largely specific to US
 - Pedagogical trends: very widespread
- Reading onscreen
 - Only single texts (not navigation of multiple texts – topic of last week's talk)
- Interpreting research findings
 - Experimental testing \neq naturalistic reading conditions

Digital: US Sales

■ Print

- Largely steady for past c. 5 years
- NOTE: Annual changes typically reflect bestsellers

■ eBooks

- High point of sales: 2013
- Numbers exclude self-published books, small publishers
- 2015 and 2016: double-digit decline in sales
- 2017 to present: declines of c. 3-4% annually

■ Downloaded audio

- Skyrocketing sales in recent years
 - 1st 6 months of 2019: +33.8%
 - 2018 vs. 2017: +37.1%

Sources: Association of American Publishers, Nielsen Bookscan

Digital Trends: Accessing News

- Newspaper reading: print vs. digital
 - US readers (Mitchell et al. 2016)
 - Age 65+: 48% in print, 20% online
 - Age 18-29: 5% in print, 50% online
 - UK: time reading newspaper (Thurman 2018)
 - In print: 40 minutes daily
 - On websites: 30 seconds daily

Note: In US, daily amount of time reading anything for pleasure was c.17 minutes in 2017 (Ingraham 2018)

Digital Trends: Social Media Use

- US teenagers, age 13-17 (Common Sense Media 2018)
 - Overall use of social media
 - 70% use social media more than once a day
 - Frequency of texting
 - 48% text either “almost constantly” or “a few times an hour”
 - Social media and homework
 - 57% say social media often distracts them when should be doing homework

Digital Trends: Shallowing Hypothesis

- Vast amounts of time with social media lead to shallow approach to
 - Daily reflective thought
 - Reading substantial academic text
 - Prevalence of social media use encourages reading quickly and superficially
- Consider evidence for this reading style in experimental research we will discuss

(Annisette & Lafreniere 2017; Delgado et al. 2018)

Pedagogical Trends: Medium of Instruction

- Moving curriculum online
 - Course materials (use of learning management systems)
 - Entire courses, degrees
- Incorporating audio, audiovisual
- Open Educational Resources
 - Overwhelming digital
- Dana's textbooks: all digital?
 - Major textbook companies
 - "Digital first" (Pearson); "Inclusive access"

NOTE: Mismatch between textbook and general US purchasing trends

Pedagogical Trends:

Reading Assignments (Baron & Mangen ms.)

- Decline in “long longform” [US and Norway]
 - Declining number of books, pages assigned (even in traditionally reading-intensive courses)
- Shift from text to audio or audiovisual (US)
 - Assigning some audio or video instead of text
 - Podcasts: 15%
 - Videos (e.g., YouTubes, TED Talks): 32%
- Are these shifts in response to student non-compliance?
 - In recent decades (including pre-digital), many college students haven't been “doing the reading”
 - Student confessions > faculty perception

Pedagogical Trends: Library Acquisition Policies

- Move from print to digital
 - Some university and public libraries have gone all digital
 - Typical library purchasing policy:
 - “We buy it in digital unless there is an explicit request to purchase print.”
- Motivations
 - Cost (in building space)
 - Convenience for patrons
 - Is appropriateness for books same as for journals?

What the Research Says about Reading Medium and Learning

■ Print versus digital

- Focus on “reading to learn” (not young children or learning to read)
- Only consider single digital texts
- Most research is with university students

■ Text versus audio

- Less research available that is relevant
- Briefer discussion here

Print vs. Digital Reading: Overview

- What factors might explain results
 - Is it the **test**?
 - Is it the **text**?
 - Is it the **technology**?
 - It is all in our heads?

Is It the Test?

Overview

- Perception studies
- Experimental studies
 - Meta-analyses
 - Type of questions asked
 - Speed
 - Reading time
 - Time pressure

Is It the Test?

Perception Studies

■ Today's discussion

■ University students

(Baron et al. 2017; Mizrachi et al. 2018)

■ Middle & high school students

(Tyo-Dickerson et al. 2019)

■ Common findings

■ Medium on which easiest to concentrate, focus, learn, remember:

- Print (71%-92%, depending on specific question)

■ Medium on which more likely to multitask

- Digital (50%-100% more likely than with print)

Is It the Test?

Perception Studies (cont.)

- Like most about reading in print for learning
 - “Feels like the content sticks in the head more easily”
 - “More concentration”
- Like least about reading digitally for learning
 - % of comments about distraction, inability to concentrate:
 - Secondary school: 47%
 - University: 21% (but 43% in US)

Is It the Test?

Perception Studies (cont.)

- Like most about reading digitally
 - “It keeps me awake”
 - “It can be a bit more entertaining”
 - “It looks shorter to read on”

- Like least about reading in print
 - Reading in print is boring
 - Secondary school: 9% of all “like least” comments about reading in print

Is It the Test?

Results of Meta-Analyses

- Singer & Alexander 2017b; Delgado et al. 2018; Clinton 2019
- Overall conclusion in all three analyses
 - Comprehension is better reading in print than reading digitally
- However
 - Not every study examined found print superior
 - Possible explanations for contradictory findings
 - Variables controlled for
 - Sophistication of questions asked

Is It the Test?

Experiments: Type of Questions

- Basic experimental format
 - Read passage (typically c. 250-750 words)
 - Answer comprehension questions
- Concrete details vs. abstract decontextualized interpretation (Kaufman & Flanagan 2016)
 - Concrete details: better with digital
 - Abstract inference: better with print
- Memory for main idea vs. key points (Singer & Alexander 2017a)
 - Main idea: similar comprehension
 - Key points: better comprehension with print

Is It the Test?

Experiments: Speed

- Amount of time set (Ackerman & Goldsmith 2011)
 - Similar comprehension

- Choose how much time you want (Ackerman & Goldsmith 2011)
 - Less time with digital
 - Worse comprehension with digital(Speed-accuracy tradeoff)

- Time pressure (not enough time for task)
(Ackerman & Lauterman 2012)
 - Better comprehension with print

Is It the Text?

Overview

- Length
- Genre

Is It the Text?

Length

- Preference studies (Baron et al. 2017)
 - Preferred medium for long academic reading
 - 86% print
- Comprehension on short vs. long texts (Singer & Alexander 2017b)
 - Short texts (<500 words)
 - Similar comprehension
 - Long texts (>500 words)
 - Better comprehension with print

Is It the Text?

Genre

- Informational vs. narrative (= expository)
- Some studies
 - Similar comprehension (digital & print) in both genres
- Other studies
 - Similar comprehension for narrative
 - Better comprehension with print for informational
- Long form narrative (Mangen et al. 2019)
 - Basic comprehension questions
 - Similar comprehension (digital & print)
 - Where in the text, when in the story
 - Better scores with print

Is It the Technology?

Digital Paging vs. Scrolling

■ The scrolling challenge

- Can't build cognitive map of what is where in the text (remember: Mangen et al. 2019)

■ Research findings

- Probably better comprehension with paging than with scrolling (e.g., Wästlund et al. 2005)
- Don't have definitive research yet
- Scrolling specially challenging for people with low levels of working memory capacity (Sanchez & Wiley 2009)

Is It All in Our Heads?

Overview

- Metacognition (“mindset”)
 - How we approach a mental task (e.g., do we think it will be difficult or easy)
- Predictions (“calibration”)
 - How well think will do (or did) on a cognitive test
- Motivation
 - Will reading in print or digital motivate Dana to read more?

Also: Personal preference (though won't discuss here)

Is It All in Our Heads?

Metacognition (“Mindset”)

- Maybe the technology isn’t primary reason for better comprehension with print
- Instead, primary reason may be students’ assumptions that reading digitally doesn’t take as much effort as reading print
 - What like least about reading in print:
 - “It takes me longer because I read more carefully.”
- Metacognition hypothesis
 - Israeli researchers (e.g., Ackerman & Goldsmith 2011; Ackerman & Lauterman 2012)

Is It All in Our Heads?

Predictions (“Calibration”)

- Predict higher scores with digital but do better in print
 - 5th and 6th graders (Golan et al. 2018)
 - University students (Ackerman & Lauterman 2012; Singer & Alexander 2017a; Singer Trakhman et al. 2019)
 - Students assume digital task will be easy; therefore don't expend effort (shallowing hypothesis)

NOTE: In studies from late 2000s, early 2010s, students predicted did better with print

Is It All in Our Heads:

Shared Themes (Mindset, Shallowing, Calibration)

- “The ever-increasing demands of multitasking, divided attention, and information overload that individuals encounter in their use of digital technologies may cause them to ‘retreat’ to the less cognitively demanding lower end of the concrete-abstract continuum. ...[T]his tendency may be so well-ingrained that it generalizes to contexts in which those resource demands are not immediately present.”

Kaufman & Flanagan (2016, p. 2776)

Is It All in Our Heads?

Motivation

- Remember students
 - Calling print “boring”
 - Saying digital looks shorter to read
- Potential advantages of digital
 - Can digital motivate students to “do the reading” more than print can?
 - Can digital motivate students to LIKE reading?
- BUT
 - Most research indicates for in-depth reading (especially informational), print has better learning outcomes

Text vs. Audio: Overview

- Cultural shift away from text
- Research on textual vs. audio learning
 - Comparative data
 - Medium preference
- Research on combining text with audio

Cultural Shift Away from Text

- “Welcome to the post-text future” (Manjoo 2018)
 - “The defining narrative of our online moment concerns the decline of text, and the exploding reach and power of audio and video.”
- YouTube statistics
 - c. 5 billion videos watched daily
 - c. ½ million hours of new video uploaded daily
- Audio listening by 18-29 year-olds (Perrin 2018)
 - 23% listened to an audiobook in past 12 months

Research: Text vs. Audio

Comparative Data

- Audio comprehension better
 - Orthopedic diseases (Back et al. 2017)
- Comprehension equivalent
 - Non-fiction narrative (Rogowsky et al. 2016)
 - Authors' caution: results could differ for informational textbooks
- Text comprehension better than audio
 - Daniel & Woody (2010)
 - 22 minute podcast or printed article
 - Written quiz two days later:
 - Print: 81% correct
 - Podcast: 59% correct

Research: Text vs. Audio

Comparative Data (cont.)

- Mind wandering (Varao Sousa 2013)
 - Reading passage aloud
 - Least mind wandering (“active learning”)
 - Reading passage silently
 - Some mind wandering
 - Listening to someone else read passage
 - Most mind wandering
 - Poorest memory for material
 - Results for reading aloud and reading silently largely equal

Research: Text vs. Audio

Medium Preference

- “Although students who listened to podcasts preferred podcasts before the quiz, after the quiz the preference for podcasts decreased. Although students did not immediately learn about their performance on the quiz (i.e., their grades), merely taking the test alerted them to the limits in their comprehension after listening”

Daniel & Woody (2010, p. 202)

Research: Text vs. Audio

Conclusions of Daniel Willingham (2018)

■ Easy vs. hard texts

- “[audio and print] equivalence for easy texts and an advantage to print for hard ones”

■ Multitasking issue

- “81% of audiobook listeners say they like to drive, work out or otherwise multitask while they listen. The human mind is not designed for doing two things simultaneously, so if we multitask, we’ll get the gist, not subtleties.”

Research: Combining Text with Audio

- Educational use of dual modality
 - Learning to read
 - Students with reading challenges
 - Second language learners
- Research findings
 - Mixed (most, but not all, show usefulness of dual modality)
- Adult use (anecdotal)
 - Slow down text reading (encounter each word)
 - Keep focus on text

What We Have Learned: Lessons and Advice for Dana

- Print vs. digital
- Text vs. audio
- General recommendations

What We Have Learned:

Print vs. Digital

NOTE: Recommendations by Kaufman & Flanagan (2016) and by Lauterman & Ackerman (2014) for improving digital performance

■ Perception

- Print better medium for concentration, focus, learning, remembering

■ Comprehension

- Overall print better for longer texts
- Print better for more analytical and detailed Qs

■ Speed

- Tend to read digital faster, with worse comprehension

What We Have Learned:

Print vs. Digital (cont.)

■ Genre

- Informational: print probably better
- Narrative: print & digital probably = for simple questions, but print better for where, when Qs

■ Digital scrolling

- Probably worse comprehension than with paging

■ Calibration

- Tend to overestimate digital test performance more

■ Source of different comprehension results

- Much is metacognitive

What We Have Learned:

Text vs. Audio

- Comprehension
 - Mixed results
 - For material requiring analysis, print probably better
- Mind wandering
 - Greater for listening than for reading aloud or reading silently
- Preference
 - Shift when tested
 - Cf. calibration for print vs. digital

What We Have Learned

General Recommendations for Dana

- Balance cost and convenience with what you know about concentration, distraction, and learning
- Don't assume you can do better with digital reading because you spend so much time online
- Remember that reading-for-learning requires more effort than social media, quick news checks, or comparing air fares
- Confront why you feel print is more boring than digital

Educational Culture Shift

- Put shallow, rapid reading in context
- Using, not reading
 - The midnight library tale
- What are our goals in education?
 - Balancing cost with learning
 - Depth of learning
 - Do the humanities and longform reading have a future?
 - Centrality of reading to serious, analytical thinking (Wolf 2019)

Suggestions for Moving Forward

- Disseminate to educators results of existing research on reading in different modalities
- Undertake additional meaningful research on medium for reading and learning
- Confront the issue of textbook cost head on
- Encourage print versions of OERs, where appropriate
- Listen to what our students tell us about how they learn best in the long term, not just how they think they will do on a test

Thank you



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How We Read Now:

Strategic Choices for Print, Digital, and Audio

(Oxford University Press, Forthcoming)