

# Differences in Print and Screen Reading in Graduate Students

Lauren J. Short

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## Introduction

For decades, if not longer, many fields have taken an interest in how people read. In composition and rhetoric studies, scholars have attempted to break with the notion that reading and writing are two entirely separate entities, and should be taught alongside one another, a conversation in which I would like situate myself (Carillo 2014; Elbow, 1993). Furthermore, in the past decade, neuroscientists have taken a distinct interest in how the human brain reads (Dehaene, 2009; Wolf & Stoodley, 2007). While cognitive studies have shown that reading physical texts leads to higher comprehension reading texts on a screen, the convenience of technology is undeniable. Some students choose to forgo reading a printed text to save money (eBooks are often cheaper than their hard copy counterparts); for environmental purposes (saving paper and ink); and for accessibility and ease of carrying multiple texts in one place.

While many studies confirm that reading in print leads to higher comprehension than reading on a screen, oftentimes the difference is minor (Jabr, 2013). In fact, some studies have prompted scholars to look beyond initial reading comprehension and consider long-term memory. According to a study in 2003, for example, at the University of Leicester, 50 students were asked to read introductory course materials either in print or on an LCD screen. The study confirmed that after 20 minutes of reading, students who read in print or on screen scored “equally well” in a multiple-choice quiz (Jabr, 2013). If differences in comprehension and long-term memory recall are negligible, people may choose reading materials based on preference alone.

In order to better understand student reading preference, I have conducted an IRB-approved pilot study in which I interviewed six graduate students from a public state university in the northeastern United States about their reading habits in print and on screen. Given that research in this area has primarily focused on undergraduates, my interviews with graduate students should provide a fresh perspective for this issue. Graduate students tend to do much more reading than undergraduates and are required to comprehend those texts they’ve read and recall them. Such expectations require them to make use of some kind of reading strategies. The existing research has also appeared to be most intent on discovering students’ on-screen reading habits, whereas my study sheds light on how reading habits and/or strategies differ between on-screen and print and why. This study reveals the reasons why graduate students prefer reading print

or digital texts and what makes a text difficult for them to interact with. This study will provide insight into what instructors can do to better serve their students when examining course-specific content.

## Theory

For the purposes of providing background on the research that has taken place on this subject, I will more deeply examine the scholarly work of Eszter Hargittai (2010) in the field of sociology as well as Tim Vandenhoeck (2013) and Gal Ben-Yehudah and Yoram Eshet-Alkalai (2018), whose work can be found in journals discussing education using information and communication technologies. These approaches to understanding digital and non-digital reading are not only relatively current and varied in disciplinary approach, but they also provide a sample of the kinds of research on print and digital literacy that has been completed in recent years. I have found them useful in terms of situating myself within the conversation and where I identify gaps in the research, namely that studies up to this point have focused on undergraduates. Because graduate students do an excess of reading, in their coursework and during their theses and dissertations, I find them a rich population for study.

Eszter Hargittai takes a nuanced approach to understanding the differences between the digital native/immigrant divide. In her 2010 study, Hargittai calls attention to the lack of evidence supporting the understanding that just because someone has “grown up with digital media” they are “assumed to be universally savvy with information and communication technologies.” In a paper-pencil survey administered to 1,060 first-year students at an urban university, Hargittai asked about gender, parents’ highest level of education, race/ethnicity, and age. Given the almost uniformity of age of respondents (traditionally-aged college students), Hargittai was able to surmise that one’s familiarity with the digital realm is more complex than one factor. In fact, this study proves that socioeconomic status has more to do with one’s familiarity with digital media and communication than any other factor. According to Hargittai’s research, higher levels of parental education, being a male, and being white or Asian American are the most likely markers of one’s digital savviness.

Tim Vandenhoeck (2013) corroborates research that claims one of the largest pitfalls to digital reading is the lack of ability to annotate. Vandenhoeck cites a study illustrating that even when students were made aware of annotation features of digital interfaces, they were uninterested in utilizing them. This reluctance may suggest a general unfamiliarity and thus, suspicion towards digital annotation that hasn’t come into the mainstream. Students do however report a willingness to engage with digital texts more frequently when explicitly instructed in reading strategies.

At the University of Limerick, Vandenhoeck conducted a survey of 630 students on their reading habits. His questions specifically referred to digital texts in the format of academic article PDFs. Results showed that nearly 3/4 of the

respondents preferred print to digital reading, though more than half said they did not print out articles either to save money or for environmental purposes. Students responded as printing out texts only when it was deemed as important to them or something for an exam. Nearly 90% of students said they annotate print texts while only 16% take notes on the computer. Interestingly, many of these same students noted that they were unaware of or didn't know how to use various annotation methods on digital interfaces.

In a recent study by Gal Ben-Yehudah and Yoram Eshet-Alkalai (2018), the researchers examined the effects of highlighting as a reading comprehension method when applied to both print and on-screen versions of text. According to the study, "when participants were instructed to use text-highlighting, performance improved only in the printed condition. Specifically, text-highlighting improved accuracy on questions that required inferential processing, but it did not affect performance on literal questions" (p. 153). While reading comprehension didn't deviate wildly from medium to medium, the study did conclude that highlighting as a reading comprehension tool can improve a student's ability to infer knowledge about information read, as opposed to regurgitating rote, memorized material. Highlighting is a popular tool for reading comprehension and thus, studies such as these are important for our understanding of how various reading strategies differ (if at all) when applied in print and on screen. Understanding this difference could lead to insight into how educators might teach their students how to read assigned texts. Students, particularly graduate students, who are asked to parse through a superfluity of course readings, are always seeking new reading strategies, particularly when those strategies will aid in comprehension.

### **Study Aims and Introduction to Research Framework**

Based on the studies in the previous section, I've found graduate student reading preference is an uncharted area of research. The purpose of my study is to examine the methods that graduate students in the university take when reading a) print texts and b) digital texts. My aim is to discover if readers take different strategies when reading in print versus reading on a screen. Furthermore, my intention in this study is not so much to discretely separate "print" from "digital" reading strategies, as I understand that some readers employ similar if not the same strategies on both mediums. In looking at print and digital reading strategies, I was curious to see if participants use the same strategies on both mediums, and if so, why. Though, I was also curious to see if there were stark contrasts in strategies in print and on screen, and what the implications of this might be.

Studying graduate students has to do with not only the significant amount of reading that takes place at the university, but also because, as a university writing instructor, I believe that reading effectively is one of the first steps to writing more coherently. Furthermore, since technology has the capacity to enhance learning, this study will provide insight into the ways that technology can

be used effectively to read. Some popular media sources, like *Scientific American*, suggest that many students prefer print to screen texts, but could it be because students have not developed strategies to read effectively on screens?

## Methods

### *Participants*

Six graduate students participated in my data collection process. One participant is a PhD student in the Composition and Rhetoric program (Claudia), one is an MA candidate in Linguistics (Gertrude), one is an MFA in Fiction (Phil), one is a PhD student in Economics (Courtney), one is a PhD candidate in Economics (David), and one is a PhD candidate in Natural Resources and Earth Systems Science (Amanda). My respondent from the MA program in Linguistics is also a multilingual speaker. Four respondents were female and two were male. All respondents were Caucasian and native speakers of English, with the exception of Gertrude. Participants were allowed to choose whether to be referred to by their first name or by a pseudonym.

### *Procedure*

Participants were asked a series of 12 interview questions (Appendix A) about their reading strategies on print and on screen. Since the term “strategy” is somewhat vague, I provided participants with a list of common reading strategies before they began the study. The purpose of this list was meant for participants and myself to come to a clearer understanding of what “reading strategies” can look like. Participants were able to use the list of strategies as somewhat of a jumping off point to speak to their own experiences, while also disclosing other strategies that did not occur on the list. This list includes:

- underlining and/or highlighting portions of text
- taking margin notes
- creating annotated bibliographies
- taking notes in separate locations
- using sticky notes
- glancing through the table of contents
- reading through headings
- identifying the thesis/main points
- using symbols as markers of important points (like stars)
- creating indexes
- using apps like Notability or iAnnotate
- choice of screen to read upon when reading digitally (computer, tablet)

The list of strategies here is not meant to be exhaustive, but more to allow participants and me to come to a common understanding of what a reading strategy looks like.

The interview process generally took about 15 minutes per person. Claudia, Gertrude, and Phil were interviewed in person, while I recorded their responses, and later transcribed the material collected. Courtney, David, and Amanda were distributed the same interview questions in a digital word processing document and asked to type their responses to those questions directly. The reasoning behind the change in procedure had to do with a perceived sense of ease for graduate students to participate in and respond to my study on their own time and from the comfort of their desired locations, instead of having to seek a time and place with me in person. There was also considerably less labor in not having to transcribe participant responses.

### *Analytical Methods*

I first employed in vivo coding (Saldaña, 2009), which led to a final discourse structure and analysis (Gee, 1999). In vivo coding is “the practice of assigning a label to a section of data, such as an interview transcript, using a word or short phrase taken from that section of data” (Given, 2008). The aim of in vivo coding is to stay as close as possible to the participants’ own words. These methods were useful to me because the in vivo coding led me to connect patterns between linking concepts that interview participants identified in their responses. From these initial in vivo codes, I was able to narrow the focus of the concepts I chose to look at in this study, which can be found in Table 1. Furthermore, discourse analysis led me to draw conclusions that weren’t explicitly stated in respondents’ words. Through this method, I was able to infer meaning when appropriate.

### **Results**

Perhaps my most significant finding is that respondents described their print and reading practices as different. Generally speaking, respondents said they did not employ similar reading strategies on screen as opposed to print because they found the digital interfaces too difficult to interact with or because they had never been explicitly trained on how to read on screen. Included below is a code chart indicating student response to my interview questions. Codes are expanded upon qualitatively below the chart.

<b>Concept (Preliminary Code)</b>	<b>Description</b>	<b>Raw Data Samples</b>
Readers Cite Ease in Reading On Screen	Instances where students expressed ease	“the convenience factor...tends to outweigh those hard copy advantages...”

	towards reading on screen	“it’s nice having digital texts of articles...because I can have a bunch of them on me at once”
Readers Cite Ease in Print Reading	Instances where students expressed ease towards reading in print	“I can make notes more easily [in print]” “It’s so much easier for me to write notes...when it’s in paper”
Lack of Training/Confidence	Instances where students indicated a lack of training or confidence in reading strategies	“we haven’t been trained on e-readers...” “I always feel nervous about technology”
Difficulty Interacting	Instances where students indicated difficulty interacting with screen reading interfaces	“It’s difficult for me to um, highlight, to make notes...when I do it on screen” “The reading on my Kindle is really... hard to access the things that I highlight...it’s just not a very good interface”

Table 1: Code chart indicating student responses to the interview questions

### *Readers Cite Ease as Motivator of Preference*

A majority of respondents cite ease (in reading, absorbing information, annotating, and on the eyes), as well as a penchant for the tactile experience for their preference of reading in print versus reading on a screen. Claudia reveals that she spends more of her time reading on a screen, and though she doesn’t explicitly state whether or not that is her preferred method, it is implied in one of her responses in which she says, “I think . . . [reading preference is] more about convenience and money . . . and portability than anything else.” According to Amanda, “the convenience factor of storing all these annotations digitally tends to outweigh those hard copy advantages for me, especially because I’m currently writing my dissertation, which requires me to review literature at a greater volume without the necessity to comprehensively understand every nuance of everything I read.” She also cites “eco-guilt” as a motivator for her tendency to read more on screen, which isn’t entirely surprising since she is part of the Natural Resources department. Though the reasons these respondents cite for preference are different, they mostly come back to what one considers to be the easiest mode to read. Claudia’s reading preference comes down to convenience and cost. For

Amanda, the preference to read digitally is multifold: ease of storage, accessibility, and a smaller environmental impact.

### *Readers Cite Difficulty Interacting with Digital Texts*

The majority of my respondents admitted that interacting with texts on screen is much more difficult than in print. When interacting with a text on screen, Phil will “at most make comments” unless he is going to be held responsible for the material in the form of a presentation or discussion. Claudia revealed that both reading PDFs on her computer and highlighting on Kindle were “terrible options” and that she wished there were better ones since the interfaces were difficult to interact with and inefficient for various reasons. Gertrude also expressed the difficulties that she faces in highlighting digital texts and taking notes, so much so that she would prefer to take handwritten notes rather than deal with the hassle of highlighting or taking notes on screen. Courtney indicated that if she “must” read on screen, she will try to highlight, especially on Adobe’s PDF Reader, but she concedes that the whole process feels much less comfortable than hard copy and highlighter pen. David responded in saying that he found the process of taking notes digitally “clunky,” as he will often write questions in the margins that he will have to go back and “cross out” once he has the answer. For these respondents, note taking and highlighting, two common print reading strategies, are difficult to transfer over digitally.

### *Readers Cite Lack of Training/Confidence in Using Digital Texts*

As Phil says, readers may be more responsive to physical texts because “we haven’t been trained on e-readers.” Furthermore, Gertrude considers that even though she prefers print reading, she can read academic articles online much easier than other formats because “they were introduced to [her] on screen. I learned about them first on screen, so I can read those easier on screen...” When asked how effective she believed her reading strategies to be, Courtney responded, “I am honestly unsure how effective highlighting is in my interpretation of a text. I think my apprehension derives from the fact that I am often unsure if I am highlighting too little information or too much. My lack of confidence in discerning what is most pertinent to highlight makes the highlighting strategy feel less effective (in my opinion).” As proven by Ben-Yehudah and Eshet-Alkalai (2018), highlighting is one of the more effective reading comprehension strategies, but as they also write, “studies found that highlighting can be harmful for comprehension . . . possibly, because the lack of experience with highlighting strategies increases extrinsic cognitive load” (158). If training for how to go about effective highlighting were provided, students may feel more confident in the strategies they utilize in reading. But that begs the question: who is to provide this training and when throughout a student’s learning process?

## Discussion

My participants' reasoning for preferring print reading to reading on a screen, citing the "clunkiness" of annotating digitally, suggests that explicit instruction with digital interfaces could benefit students making use of these technologies. Instructors may assume that their students, especially their graduate students, already know how to read and effectively understand texts regardless of medium. However, as my study suggests, students may not feel as comfortable reading digital texts as they do print ones because they lack instruction. Further research could aid instructors in guiding their students towards the development of effective digital reading habits.

As with any discussion of technology as an educational resource, access is a factor in who has greater convenience in utilizing digital texts, if preferred. The fact that all of my participants were able to choose whether to utilize print versus screen texts indicates a level of privilege that not all students have available. Unfortunately, my study does not contain insight from those in lower socioeconomic statuses, though I hope future studies, including my own, will contain a more varied set of voices.

Seventy-five percent of Vandenhoeck's (2013) respondents preferred reading in print, though they chose to do their course readings online if that was the format in which they were posted by their instructors. The same is true of all of my participants. The majority of Vandenhoeck's participants would take notes on print texts, though a slim 16% would do the same on a screen. Again, this finding correlates with my own study in that Phil noted that he would "at most take comments" when reading digitally, which differs from his print reading practices. He goes on to say that he would only take notes or highlight on screen if "I absolutely need to know what I'm talking about, I have to be in a discussion, [or] I have to really engage in the text." Similarly, Gertrude avoids reading on screen and will only do so if she doesn't have printer access because she finds the process disconcerting. She takes separate handwritten notes when reading digitally, whereas she is able to make margin notes on print texts. Claudia, though abler to navigate screen reading than other participants, still commented on the inefficiency of taking notes and highlighting on PDFs and Kindle. Courtney emphasized that she would highlight digital texts only if she "must" read in that format and there was no other option.

Finally, Vandenhoeck speaks to student uncertainty and unfamiliarity with digital interfaces. As mentioned previously, Phil comments that we haven't yet been trained as a population to use e-readers, and as Gertrude reflected on her own literacy practices, she realized she is better able to read academic articles in digital format because that is the first format in which they appeared to her and were, in a way, "taught" to her. These findings suggest that not only does a lack of technology cause hurdles for students to overcome when reading online, as with Claudia and David, who find the process of reading on their computers or



Kindles “clunky,” but a lack of explicit instruction in how to best utilize reading strategies on various interfaces causes hurdles, as well.

Courtney’s lack of confidence in whether her highlighting is effective further ties in with Ben-Yehudah and Eshet-Alkalai’s (2018) understanding that a lack of experience can lead to an augmented cognitive load. Confidence in one’s ability to effectively learn comes from experience and training, among other things. As alluded to earlier, how can instructors equip students with confidence in their abilities to read and learn most affectively? When would this kind of training take place (elementary school, middle school, high school, or college)? If students are taught to write within the confines of their specific disciplines and the genres within, would it then be appropriate to suggest that instructors in biology teach their students how most effectively to read texts relating to biology?

Reflective of Vandenhoeck’s (2013) study at the University of Limerick, it appears as though part of the reason students prefer print reading to screen reading is familiarity. In Vandenhoeck’s study, students were mostly uninterested in using digital annotation, though the majority did make use of annotation on printed texts. While students often pick up instruction on annotation strategies for print texts, instructors are less likely to translate these strategies or offer instruction in how to do so digitally.

The links between reading and writing “fit naturally together” (Elbow, 1993, p. 5). So my conclusion is that it would be an organic move to teach a lesson(s) on how to read, especially before assigning texts that are genre and discipline specific. Instructors could simply show students how they read as a sample—not as a mandate, but as an example of how one accomplished reader successfully navigates the field. Instruction of this type could lead students to develop a greater set of reading preferences beyond print. Once students gain a clearer grasp of how to read digitally, they will begin to feel more comfortable doing so.

Instruction could take the form of photocopied versions of a text the instructor has read and the types of annotations present—highlighting, margin notes, etc. If there are any strategies that don’t show up physically on the page, the instructor could talk about that with his or her students (e.g. notes that may have been taken outside of the text, post-its that have been removed, etc.). Talking through this process can provide students with one method through which to navigate a text, or remind them of strategies they may have forgotten. If instructors took the time to divulge this process to students in multiple disciplines, students would start to see what strategies work well for them in certain contexts. How one reads in science may be ineffective in the humanities, for instance. Alternatively, students will gain habits that serve them well across multiple genres and disciplines.

Perhaps the most significant limitation of this study is size. Gaining insight from a greater number of students could only validate my claims further or,

paradoxically, reveal that reading preference is more deeply complicated than I originally imagined. In the future, I would like to open this study to undergraduates and faculty, as well as have participants perform reading tasks in print and on screen while I observe. Further research could also inquire if discipline has any influence on preferred method of reading.

## Conclusion

As suggested by Vandenhoeck (2013), students need explicit instruction in how best to read on screen. He proposes a digital literacy workshop that university students could take after their first semester to teach them annotation strategies on digital texts. I would recommend this approach, though how we go about teaching and appointing who has the most qualifications to teach such a workshop may be a future issue to contend with. As I've suggested above, I believe the way to go about alleviating the burden of who will teach digital literacy workshops and the resources that might require is by having instructors talk about how to read and mark up a text, before assigning their first reading assignments to students. Students should also be provided multiple samples of what the instructor has read in print and on screen, when possible. Allowing students to practice reading strategies, not only in one medium but in both print and screen, will provide them with confidence to read more effectively, as well as more options. Students who feel as though they are reading ineffectively on screen may learn how to navigate this medium more successfully, providing them with the training and confidence that many students in my study felt they lacked. Furthermore, as technology advances, hopefully digital interfaces will become easier to interact with and more intuitive to use, though it is worth noting that technology is constantly changing, and everyone, even digital "natives," will need to be updated frequently. Instructors should try to remain vigilant to the technologies emerging around them, so as to best be prepared for how to accommodate their students. It will also be interesting to consider the next generation of teachers—true digital "natives" who will have completely grown up with technology at their fingertips—and how this affects future pedagogies.

There can sometimes be resistance from instructors who do not feel it is their responsibility to teach writing in addition to course-specific material. While this is a legitimate concern, it can be difficult for students to know how to write within a genre and discipline with which they have no familiarity. Similarly, it can be a struggle for students to keep up with course readings that require a level of comprehension when they have never been assigned reading in the genre or discipline before. Instructors may be blind to what their students don't know because they have so much experience that the process feels natural to them. In order to best serve students, instructors should consider what it was like when they first started out in their disciplines and if there were any strategies they picked up along the way that may be useful for their students to know. Lessons such as these can contribute to richer classroom conversations because students are not only aware of what they need to read, but how to read it.

Teaching students to read within their disciplines or within unfamiliar genres may seem to be an expenditure of time that instructors cannot afford alongside course-specific content and material, but transparency on the part of an instructor is incredibly valuable and can take less time than imagined. Bringing in metacognitive practices and exercises in the classroom can allow students to understand why certain disciplines value things over others, and that we do not simply follow arbitrary rules. If it feels as though classroom discussions are lagging, I would encourage instructors take part of a lesson to show students how to read the material. Instructors should share with students how they read, personally. Reading seems like a self-explanatory task and one that needn't require focus in the classroom, but the time it takes to discuss how to read is miniscule in comparison to the frustration of a room full of students who couldn't parse out the nuances of a text. Vandenhoeck's (2013) research shows that students will most often read the text format assigned to them in class. Instructors assigning digital texts can provide instruction on how to read these texts so that students who prefer to read in print will gain greater comfort interacting in a new format. Students who prefer reading digitally may also gain further insight into their own practices. While the lesson might be lost on some, there will be students who will not only learn how to read for the course they are currently taking, but will also be able to take that knowledge and apply it as they move forward in their educations.

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## Appendix A: Interview Questions

1. Do you prefer reading in print or on screen? Why?
2. Do you typically read in print or on a screen?
3. What is your main motivation behind either reading in print or on a screen?
4. Does the type of reading that you are doing influence your choice of hard copy or digital medium (i.e. reading for school vs. web browsing)?
5. Do you believe that you read more effectively in print or on a screen? Why?
6. Do you take notes, highlight, write in the margins, etc. while reading? If not, how do you recall information you'd like to come back to later, especially during in class discussions?
7. What strategies do you employ to help you comprehend the text you are reading?
8. Do you use the same methods while reading in print as you do when reading on a screen? If not, how do your methods differ?
9. Where did you learn the strategies you employ to help you comprehend a text?
10. Do you believe the strategies you use to comprehend a text are effective? Would you be interested in gaining information about alternative comprehension strategies?
11. Do you believe print texts or digital texts are more convenient? Why or why not?
12. Would you be more likely to read digitally if you believed it afforded the same (or more) benefits as reading in print?