

On-screen versus On-paper Reading: Students' Strategy Usage and Preferences

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Reading professionals at the college level have long taught their students multiple and varied strategies to master textbook reading and learning. Students are continuously encouraged to adapt their strategies to the discipline and the type of text they are reading. Now that students have the option to complete at least a portion of their academic reading electronically, students must adapt these traditional strategies to reading on screen. The objectives of this study were to (a) determine what strategies students are using when reading in each format and (b) ascertain what format students prefer. Two hundred thirty-seven successful students enrolled in higher-level reading intensive courses were surveyed. Results showed that strategy-use was somewhat determined by the format, but that students overwhelmingly preferred to read and study on paper.

Literature Review

College students have always been expected to read and retain large amounts of material. For example, college textbook chapters often exceed 30 pages. To help students master this level and amount of information, reading professionals have consistently advocated multiple and varied strategy usage in their

developmental reading courses. The strategies that are generally endorsed as effective include

- Previewing
- Predicting
- Accessing background knowledge
- Forming questions and reading to find the answer
- Annotating
- Reciting
- Reviewing

Rather than promote one rigid formula, developmental reading instructors cover multiple strategies and encourage students to transfer these strategies to their other courses, choosing the strategies that work best for them with the type of material they are reading (Simpson, Stahl, & Francis, 2004). In general strategies can be divided into three groups and viewed as a process occurring during three segments of the reading experience (for example, before, during, and after reading) with students having the liberty to do what seems most effective for them throughout the reading (Coiro, 2003; McGrath, 2005).

In response to concerns about the cost of traditional textbooks compared to the lower cost of electronic textbooks and the accessibility of technology by college students and professors, the publishing industry has been promoting the electronic purchase of textbooks (Christopher, 2008). For example, Pearson advertises that the average savings is \$63.51 per textbook and offers ebooks for iPhone, iPads, Android and Apple devices (www.coursesmart.com/go/mobile). In a survey by the Pearson Foundation in 2011, 48 % of the college students surveyed felt that tablet computers would replace textbooks within the next five years (Fischman, 2011). One of the first institutions to adopt electronic textbooks was Ball State University when in 2008 the nursing department required that all students to purchase AT&T mobile devices through which they access laboratory books, medical dictionaries and other resources

(Carter, 2009). At Seton Hill University, all students and faculty receive an Apple iPad on which they download textbooks, take notes, and communicate (www.ipadonthehill.com). California University of Pennsylvania, with one of the largest undergraduate and graduate on-line curricula, offers 19 graduate and numerous undergraduate and certificate programs all completely online (www.calu.edu/prospective/global-online).

While there are similarities between reading on screen and reading on paper, there are also major differences. The cognitive demands on the reader are in some ways the same. Horning (2009) states that whether students are reading print or digital material, they still must use the same basic processing skills including the decoding skills of identifying and discriminating the basic letters, predicting using background knowledge, and keeping information in their short-term memory long enough to put the information together. The major difference between on screen and on paper is obviously the format. Reading on screen, particularly when connected to the internet, presents a new format style which is non-linear, has the possibility of adding multiple types of media within the text, and can be quite interactive (Coiro, 2003). Studies conducted by Sanchez and Wiley (2009) suggest that comprehension suffers when text is presented in a scrolling format. This refers to printed text that does not completely fit on one screen and requires the reader to use the mouse or toolbar to see the rest of the text.

Another factor in comprehension is how well the reader is able to maintain focus when reading a long passage such as a textbook chapter and, related, how successful the reader is in understanding the overall scope of the material. A reader's inability to successfully comprehend a passage is often due to a combination of factors such as the inability to maintain interest or concentration, understand how sentences relate to one another, and understand how the information fits together in a meaningful way—how it is organized (Taraban, Rynearson, & Kerr, 2000). Given the possibilities for distractions when reading on screen, Coiro (2003) states that those students who were observed reading on screen selections exhibited "shallow, random and passive interactions" with the material. Carr (2008) reported that he and

others found that they had difficulty staying focused when reading long selections on the web.

Considering student preferences, research conducted by Spencer in 2006 with Canadian undergraduate and graduate students enrolled in online courses found that, regardless of their ages and experience with new technologies, the students preferred printed materials by a wide margin. Their reasons: the print format is easier to use in a variety of environments, and it is more flexible and more dependable.

Given these findings about the preferences of students for paper formats, developmental reading professionals must begin to prepare students to meet the current demands of reading on screen and to equip them to be able to adapt to what is to come. A starting point for designing classroom instruction is to identify the on-screen strategies successful students use. Also, instructors need to know what formats students prefer and why. The study reported here sought to answer these questions as the beginning step for our profession to move forward and prepare our students to be effective readers in all formats.

Method

Terminology.

For the purpose of this study, *on-screen* refers to reading done for a course assignment on any type of electronic device. Electronic devices include, but are not limited to, computer screens, electronic book devices such as the Kindle, iPods, and smart phones. *On-paper* refers to traditional types of academic reading using a textbook, trade book, or printed page.

Participants.

The participants in the study consisted of 237 undergraduates studying at an Eastern mid-size public university. Students surveyed were successful upperclassmen in reading-intensive courses where on-screen reading materials were assigned by the professor. The levels of the classes ranged from sophomore (200 level) to senior (400 level). Any survey response indicating that he/she had earned 30 or fewer credits was eliminated from the pool. Of the final 237

students, only .8% indicated a cumulative grade point average of below 2.0 on a 4.0 scale.

Procedure.

Researchers have found that a primary characteristic of skilled readers is that they flexibly apply multiple reading strategies in a purposeful manner. These include pre-reading strategies, such as setting a purpose and goals for reading, and making predictions about what the author will say; reading strategies, such as varying reading style according to the difficulty and purpose; and reviewing strategies, such as paraphrasing and summarizing (Lorch, Lorch, & Klusewitz 1993; Poole, 2008-2009; Simpson, Stahl, & Francis, 2004). Therefore, in this study, we constructed a questionnaire to determine which common pre-reading, reading, and reviewing strategies students used when reading on paper and on screen.

The surveys were conducted using paper and pencil questionnaires to incorporate both multiple-choice questions and open-ended questions. The open-ended questions were important in this initial research phase to gain insight from the student responses about strategies that we might not have considered.

Professors whose required textbooks were available as an e-book were initially contacted by the researchers. This was not successful as the professors reported that they did not require the e-book format and that most of their students had purchased the paper textbooks. Next, professors using supplemental on-screen materials were identified using a combination of peer educator recommendations and library lists of professors who had put articles on electronic reserve for their students. Using this list, 13 classes in 200-, 300-, and 400-level sections across seven disciplines (criminology, history, sociology, English, child development, anthropology, and philosophy) were surveyed. The survey was administered during the middle weeks of the 14-week spring semester so that students would have a good grasp of the reading required for the course.

The institution received a grant from the College Reading and Learning Association to conduct the research. Included in the grant was funding to train peer educators to administer the surveys so that all data were collected under similar conditions with

all subjects receiving the same information. Part of their training included taking a pilot survey to help the researchers refine the questions. Sixteen students were trained and ten were able to conduct the surveys in various classes. The remaining student assistants were unable to conduct the surveys due to scheduling conflicts.

Results

The results showed a slight positive difference in the strategies selected when beginning a new reading assignment on paper versus on screen. As table 1 shows, of the four strategies surveyed, students responded that they used the strategy more frequently when reading on paper than on screen except for looking at graphics, in which 2.1% of the students indicated they did that more often when reading on screen.

Strategies Used when Beginning a New Assignment
Table 1

When you begin a new assignment, which strategies do you routinely use?	
Read chapter headings and subheadings	On paper 84%
	On screen 72.2%
Look at graphics	On paper 48.1%
	On screen 50.2%
Read end-of-chapter summaries and questions	On paper 48.9%
	On screen 39.7%
Clarify purpose	On paper 22.8%
	On screen 19.8%
Access background knowledge	On paper 40.1%
	On screen 34.2%

The students indicated a slight difference when asked about the strategies they used when they were having trouble with

cognition. In two cases (defining words and reviewing graphics) students indicated they did this more frequently on screen. Students selected to read surrounding paragraphs and ask for help more frequently when reading on paper (see table 2).

Strategies Used when Having Trouble with Comprehension
Table 2

When reading and have trouble understanding, what do you do?	
Define words	On paper 55.3%
	On screen 58.2%
Review graphics	On paper 27.8%
	On screen 32.1%
Read surrounding paragraphs	On paper 78.5%
	On screen 60.8%
Ask for help	On paper 21.9%
	On screen 18.1%

When reviewing an assignment for an exam, students reported that they more often re-read notes they had taken during the reading process when they were reading on paper. They reported they were more likely to re-read just portions of the text when reading on screen (see table 3).

Strategies Used when Reviewing for An Exam
Table 3

When reviewing an assignment for an exam, what do you do?	
Reread the entire assignment	On paper 43.5%
	On screen 33.3%
Reread portions	On paper 56.5%
	On screen 61.6%
Reread notes taken while reading	On paper 70.5%
	On screen 55.3%

A large difference was seen when students were asked which format they preferred and which format aided or detracted from

their learning. They overwhelmingly indicated that they remember better when reading on paper (see table 4), concentrate more effectively when reading on paper (see table 5), prefer on paper over on screen, (see table 6) and are more easily distracted when reading on screen compared to on paper (see table 7).

Remembering On-Screen Material versus On-Paper Material Table 4

When you've read a long assignment (more than 5 pages), do you remember more effectively when you read it

On screen	5.9%
On paper	60.8%
No difference	27.4%
It depends on	5.9% (Student submitted open-ended response)

Concentrating with On-Screen Reading versus On-Paper Reading Table 5

When reading a long assignment (more than 5 pages), do you find you concentrate more effectively when you read it

On screen	7.2%
On paper	72.6%
No difference	17.3%
It depends on	2.5% (Student submitted open-ended response)

Preference for On-Screen versus On-Paper Reading Table 6

If you had a choice of format, which would you choose?

On screen	11.8%
On paper	71.7%
No difference	11.0%
It depends on	5.5% (Student submitted open-ended response)

Distractions with On-Screen versus On-Paper Reading Table 7

When reading, are you more easily distracted/your mind wanders when you read in which format?

On screen	71.3%
On paper	8.4%
No difference	17.7%
It depends on	2.5% (Student submitted open-ended response)

Discussion

From the results of this study, it appears that successful students are using effective strategies when reading on screen and on paper. However, depending on the format, they may be making some slightly different strategy choices. In all questions except three, students reported using the strategies surveyed at a slightly higher percentage when reading on paper compared to on screen. The three strategies that were reported to be used slightly more frequently on screen were (a) reviewing graphics, (b) defining words when readers had trouble understanding, and (c) re-reading just portions of the text when reviewing for an exam.

Although this was not mentioned in the open-ended comment section, the ability to easily define words is one of the benefits of on-screen reading. Since we know that vocabulary knowledge increases reading comprehension (Simpson, Stahl, & Francis 2004) and previous research studies have shown that when students come across an unknown word in a paper text, they spend little time searching the text for context cues or looking up the word's meaning in a dictionary (Nist & Olejnik, 1995), the ability to easily define words is one of the benefits of on-screen reading.

The most striking finding is the large percentage of students who report that they prefer reading on paper and the accompanying reasons:

- Remember better when reading on paper (60.8%) compared to on screen (5.9%)

- Concentrate better when reading on paper (72.6%) over on screen (7.2%)
- Prefer reading on paper (71.7%) over on screen (11.8%)

Another notable finding is the large percentage of students who report that they are much more likely to be distracted or find their mind wandering when reading on screen (71.3%) compared to when reading on paper (8.4%).

Recommendations

With the increased cost of textbooks, it is inevitable that more students will be reading academic materials on screen. However, to achieve their comprehension goals, readers will still need to combine multiple strategies to maximize their understanding and memory of text information. Therefore college reading professionals must continue to focus on helping students acquire a “toolbox” of reading strategies, with explicit instruction in applying the strategies to different formats.

Professors should continue to instruct and model how and why students must make important decisions about what they want to know and what combination of strategies will help them successfully gather that information. As research continues to show, a primary characteristic of skilled readers is that they flexibly apply multiple reading strategies in a purposeful manner (Brown, El-Dinary, Pressley, 1995). Students must understand the need to use their many skills, strategies and knowledge bases in combination, and often in parallel to understand what they read.

In addition, since this study clearly indicates that maintaining concentration when reading on screen is a problem, strategies must be developed, taught, and modeled to minimize distractions and maximize concentration. Classroom discussions concerning eliminating such distractions, time management and effective study environments are needed to help students deal with this issue and successfully manage their on-screen reading.

Suggestions for Future Research

Reading and learning on screen is becoming more common

in academia and continued research is needed. This research, for example, gave students “useful strategies” prompts. Future researchers could ask students to list specific strategies they use when reading on screen. Researchers could identify whether students are using adaptations of traditional strategies or something entirely new that has been created for on-screen reading.

Furthermore, researchers in this study did not ask about using any helpful e-device applications. It would be useful to investigate how students are using applications such as highlighting and side notes to help with reading comprehension. In this study, researchers surveyed successful upper-class students. Future research could focus on developmental reading students to discover what strategies they are using when reading on screen, how successful they are when reading on screen compared to on paper, what difficulties they are experiencing in the two formats and what repair strategies work best. Another feature of the study reported here is that the researchers asked about “on-screen reading you are doing for this course,” and did not differentiate among types of academic material. With additional studies, researchers could ask students if they use different strategies for reading different types of material on screen.

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Appendix
Representative student comments:
I. Senior-level Philosophy class

I can write on paper in my own words more easily than on a screen.

Paper is easier to read, concentrate on, and take notes on. I like having online access to materials so I can print extra copies and use Ctrl+F to find information later.

On-screen reading is harder on the eyes, necessitates the use of my computer and an available electric outlet, and there are many distractions only a click away. On-paper reading is easier on the eyes, can take it anywhere, and I am able to take notes in the margin and/or use a highlighter.

I find it WAY more difficult to concentrate and to absorb the information when reading on screen. I am a visual person and so the "variated" underlining, circling, boxing and recording of my thoughts that I do on paper assignments is absolutely vital to my understanding of the paper. It is how I get the information to stick in my brain.

On-screen seems to take longer and is frustrating because it is difficult to see how far you've gone/have to go. Also, on-screen often doesn't allow for writing notes around what you read or to underline/highlight important parts.

I can't mark up on-screen readings, which is one way I focus with on-paper formats. Also, on-line distractions are more prevalent for on-screen readings.

I am more likely to get side-tracked when reading on screen, and I can highlight when reading on paper, so on paper is my

preference. Retention when work gets done though, is the same or only negligible difference.

I don't see the difference. I still get just as distracted with on paper as I do on screen. With paper and on screen I'm still able to make notes in the proper area.

II. Sophomore-level English class

My eyes get fatigued after reading a lot of material on screen much more easily than on paper. I have to sit in different positions to read on screen than with a "Kodex" or print out. Variety of places I can read is also less with on-screen as I do not purchase e-books - only find the text online.

I find I am more easily distracted when I read online.

I do a lot of both on-screen and on-paper reading. I like on-screen reading because it makes it easier to look up things I do not understand. I prefer on-paper reading when it comes to longer materials like novels. It is easier for me to become distracted on screen because I can look up different search engines.

On-screen lets me read multiple articles whereas on paper I only focus on what is given to me.

Hurts my eyes on screen more.

III. Junior-level English class

Reading on screen is easier, mostly because the font is bigger and there are more graphics to look at.

On screen I am distracted and tempted to do other things while on the computer.

On-screen involves less hassle, eliminates the need to waste money on useless overpriced books, and is much easier to comprehend. Doing anything else is a foolish waste of time.

One of the biggest differences is the notes/highlighting I can do when I read on paper. Sometimes it's easier to get distracted when I read assignments on screen. I can make informed notes and questions I might have more easily on paper than on screen.

IV. Junior-level Criminology class

I concentrate and retain more by reading things on paper. I

always print readings off if they are on the computer.

I focus on the reading better when I have a paper copy. I also like to highlight or take notes on the paper while reading - which has to be done on paper.

I lose concentration quicker and can be distracted by facebook, email, etc. Also, it hurts my eyes.

The print is smaller on screen and harder to follow by scrolling down.

If you don't make the print really small you have to do a lot of scrolling. It's convenient but not like having a book you can read basically anywhere.

You can't highlight on screen.

On-screen is just convenient and you never have to worry about losing materials.

On-screen hurts my eyes and also is less "portable." I can't take it anywhere and read it. I have to lug my laptop. Also I will get more distracted on screen because I'll be playing on the internet.

On-screen creates more of a headache than actually making the reading easier.

On paper is easier on my eyes, easier to make marks on and add additional notes to as well as easier to take with me.

The main differences are seating postures and effects on my eyes.

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