Online or Print: Which Do Students Prefer?

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Abstract. Many studies indicate that the format of a text, electronic or print, impacts comprehension and depth of learning, both of which are essential skills for information literacy. How cognizant are college students of this effect? When they need to read a text for academic purposes, do they express a preference for print or digital? This paper discusses a survey of reading format preferences and behaviors of 390 undergraduates at the University of California, Los Angeles (UCLA), a large public university. Results will interest librarians, educators, and technology policymakers. The simplicity of the questionnaire makes it a viable instrument for use by researchers in other language communities and cultures.

Keywords: Print reading, electronic reading, academic reading, reading format preferences, college students.

1 Introduction

Among the indicators of information literacy is the ability to synthesize information and construct new concepts. Reading comprehension – the ability to process and understand a text's meaning – is vital to this skill. Research into the cognitive process of reading indicates that the format of a text, electronic or print, can impact comprehension. Browsing and scanning are effective strategies for cursory and defined information needs, making them ideal for many online tasks such as sorting through email, reviewing headlines, and fact checking. But researchers are now discovering how the process of linear reading in print format is more effective for deeper learning and comprehension.

College students in the United States are expected to purchase the books and materials required for their classes. This can include textbooks and course readers – customized selections of chapters and articles assembled for a particular course – and cost students up to $1,000 or more annually. Some required material may be available on reserve in the campus library for limited use. Today's electronic technologies also enable instructors to post significant portions of class readings on course webpages, allowing free and convenient access to enrolled students and relieving them of a major expense.

But what do the students think about the different reading formats and what factors influence their actual behaviors? This paper presents findings from a recent study

S. Kurbanoğlu et al. (Eds.): ECIL 2014, CCIS 492, pp. 733–742, 2014.

which investigates students' format preferences when engaging with their coursework, and the factors that impact their preferences and behaviors.

2 Review of the Literature

Since the advent of electronic books and readers, discussions in popular culture tend to assume that paper-based media will be replaced by digital versions, much like clay tablets, papyrus, and parchment in their time. Public, academic, and school librarians recognize the unique qualities of electronic resources and the need to integrate them into their collections. Many, however, face pressure from administrators and others to replace entire print collections with electronic versions, and supplant print books with dedicated e-readers and tablets. Adherents see this as a progressive development rather than following a "19th century mode of learning and teaching that is doomed and increasingly irrelevant" [1]. But there is a growing body of evidence showing how the brain processes information differently depending on the presentation format. Readers employ different levels and types of reading according to the purpose and desired outcome of a reading task, and reading efficiency varies according to format.

In summarizing several studies on this issue, Eshet-Alkalai and Geri write "online reading creates a higher cognitive load on the reader compared to reading from print," resulting in readers remembering information more from print than from digital display [2]. Disorientation and difficulties with knowledge-construction are more common when reading electronically, as well as readers' "lower sense of ownership, engagement and willingness to learn." Ackerman and Goldsmith [3] report in their study of untimed reading that performance was lower for the on-screen learners (OSL) than the on-print learners (OPL). The OSL group also demonstrated a significant difference of overconfidence when predicting their performance than the OPL group, reflecting a distorted sense of their own proficiency.

Mangen, et.al [4] conducted a study in which 72 Norwegian tenth graders were divided into two groups. Pre-tests determined any existing differences in reading abilities and these were factored into the final analysis. All the students were given the same text, but one group read it in print and the other as a PDF electronically. Results from comprehension tests showed that students who read the text in print scored significantly higher than those who read the PDF. Considering that the subjects in this study are all teenagers, it appears that the impact of format on deep reading effectiveness is not determined by generational differences of habit but is an actual cognitive phenomenon.

The popular press is beginning to bring these studies to a broader audience. Both the *Washington Post* and *Wired Magazine* discuss the impact of online reading on deep reading skills in articles titled "Serious reading takes a hit from online scanning and skimming, researchers say" [5]; and "Why the Smart Reading Device of the Future May Be…Paper," [6]. Educated adults discuss their own difficulties transitioning from online scanning mode to the deeper focusing skills needed to read novels and classic literature, and some note that university students today seem unable to read works which require sustained focus and concentration.

In 2010 the University of California (UC) conducted a survey of its students, staff, faculty, and researchers across all ten campuses on academic e-book usage [7]. A total of 2,561 responses were analyzed, of which 498 were from undergraduates. When a respondent answered 'yes' to the question "Do you use e-books for your academic work?" they were asked the follow-up "When doing your academic work, do you generally prefer print books or e-books?" Of the total responses to this question (2410), 49 percent stated a preference for print books, 34 percent for electronic, and 17 percent answered no preference or that it depends on the context of the usage. Analysis of preference by university status showed that undergraduates held the least preference for using electronic books for their academic work. "Undergraduate students indicated the highest preference for print books (53 percent); many undergraduate respondents commented on the difficulty they have learning, retaining, and concentrating while in front of a computer." Comments by students also mention the price factor, "If they were the same cost I would prefer the paper version because reading on the computer makes it harder for me to understand the information."

The current research is based on a finding from this author's earlier ethnographic study of undergraduates' academic information management behaviors at UCLA [10]. Thirty of forty-one participants expressed preference for print academic material, but many admitted that they like having the option of electronic texts because of the convenience and often, the lower cost of access. Reasons for print preference include eyestrain from electronic screens and too many online distractions, but the most common comment is that they learn better when they read in print. Often their actual behaviors depend on the context of the reading – if it is long, in-depth, central to the topic of their class, they prefer print. If it is short or supplementary, then electronic is fine. Data gathering was conducted in Fall 2009, just before iPads and tablets entered the general market and before the current ubiquity of smartphones.

3 Methodology

3.1 Research Questions and Instrument

The main research question of this study is: *What are undergraduates' format preferences when engaging with their academic readings?* Secondary questions ask: a) *What factors impact their preferences and behaviors;* and *b) How do these factors impact their behaviors?*

The Academic Reading Questionnaire (ARQ) is an online survey of 22 questions based on student comments and findings from earlier studies. The instrument consists of 14 Likert-style statements regarding students' preferences, behaviors and attitudes towards reading academic texts in electronic and print formats. Students can answer: Strongly agree, Agree, Depends, Disagree, or Strongly Disagree. Space is included with each question for respondents' comments, which are encouraged but not required.

Six additional questions ask demographic information: Strongest language, age, cumulative grade point average (GPA), year of study, major of study, and whether the respondent has a visual or other limitation that influences format preference. One

question asks about devices used to read electronic texts, and a final open-ended question asks: What else would you like us to know about your academic reading format preferences?

3.2 Sample Population

About 28,000 undergraduates are currently registered at UCLA. Recruitment emails for this study were sent to a random list of 5,000 students through the Office of the Registrar in April and May 2014. A total of 390 responses were received, a response rate of about 8 percent.

Ages of participants range from 18-60 years, with the average at 20.55 years. Students in their first and third year of study are the largest groups of respondents (29.7 percent and 27.9 percent respectively); second and fourth year students are 21.7 and 18.6 percent of respondents, and 2.07 percent reported 5th year or other. Over 90 percent agree or strongly agree that English is their strongest language, and most students (84 percent) say their grade point average is at least 3.0 out of a maximum 4.0 (equal to a 'B' grade or better). Using UCLA's Academic Divisions to categorize the participants' fields of study into general disciplines (some students list double majors), the distribution shows more science students (53 percent), than arts, humanities, or social sciences students (46 percent). Almost 10 percent of the respondents report visual or other limitations that influence their reading format preferences.

4 Results

All fourteen questions that focus on students' preferences and reading behaviors require a response. Therefore each statement received 390 responses (100 percent). The purposes of these statements can be divided into two general categories – those that investigate students' reading preferences and their behaviors that reflect reading preferences, and those that focus on learning engagement. Results below are discussed within the context of these two categories.

4.1 Reading Preferences and Behaviors that Reflect Reading Preferences

Nine questions in this instrument refer to reading preferences or behaviors that reflect reading preferences. Overall, students show a clear preference for reading their course readings in print format over electronic, but often the higher cost of print material and the convenience of electronic access determine their actual behaviors. Context and lengths of the readings are also considerations frequently noted; students are more likely to read, or prefer to read, shorter and 'lighter' texts electronically – information that is supplementary or not core to the class discussion or assignment. When they feel a reading is essential, students express an overwhelming preference for print, stating that they find it more effective for deep engagement and learning. Several comments throughout the survey also mention eyestrain and fatigue as

reasons to prefer print format over electronic. Results and selected comments are detailed below.

Survey questions 3 and 14: *"I prefer to have all my course materials in print format (e.g. book, course reader, handouts),*" and *"I prefer to read my course readings electronically,"* ask about academic reading format preferences in general. Question 5: "*I prefer to print out my course readings rather than read them electronically*;" refers to a behavior that reflects a format preference. Question 6: "*I like to make digital copies of my printed course materials,"* is meant to discover if students engage in the mirror practice of question 5, although it is possible that students prefer to read in print but make digital copies for reference and archival purposes. These four statements do not specify any length, topic or context of the readings, and the purpose is to get a general sense of the students' overall inclinations.

Results show a clear preference for reading in print. The 212 comments generated by these four questions help explain and qualify the answers. Comments are coded into categories including: the high cost of print material; better learning with print; preference depends on context (e.g. length of reading, importance to course, and personal interest); eyestrain caused by reading on electronic devices; convenience and ecological advantages of electronic format. Selected comments are listed below. Figures 1 and 2 illustrate responses to questions 3 and 14 by percentage.

- "It just depends on what I need the material for. Do I need it for an assignment or paper? I will want print. Do I just need to read it? I prefer electronic. Electronic readings make my life a little easier because instead of lugging around several books or a bunch of paper, I just need my laptop."
- "Takes too long and costs too much to print out all my readings. Just too much of a hassle."
- "I like to have a digital copy as well for backup but I learn better with print."
- "I like cheaper versions of readings, but I prefer to have the materials physically. Reading on the computer is distracting."
- "Depends on the difficulty of the class. If I need to interact with the text, e.g. highlight, annotate, in order to understand the material, I prefer print format. Otherwise, digital material is easier to carry and saves paper."
- "[Print is] completely un-ecological and unnecessary."
- "[Print is] easier on the eye than it is to read using a laptop."

Three questions ask for format preference depending upon the length of the reading: under five pages (Question 8), over five pages (Question 4), and over ten pages (Question 10). Over 47 percent (n=186) agree or strongly agree that they prefer to read a shorter reading electronically (Figure 3). Almost 75 percent (n=292) agree or strongly agree that they prefer to read longer readings in print. Distinct differences are found between shorter and longer texts, but consistent whether the reading is longer than five or ten pages.

Question 11: *"I prefer electronic textbooks over print textbooks,"* is the only question in this survey that refers to a specific type of academic source. Just under 20 percent agree or strongly agree with this (n=75), and almost 68 percent disagree (n=265). Among the 62 comments, students who favored e-textbooks note the heavy weight and cost of print: "I only prefer electronic textbooks if I have to carry them

around." Many commented on the positive aspects of both formats: "Electronic textbooks provide easier access for looking up something, but print textbooks are easier for understanding."

Perceived convenience of electronic material is the focus of Question 2: *"It is more convenient to read my assigned readings electronically than to read them in print."* Responses are almost split evenly: 41.0 percent (n=160) agree or strongly agree, and 40.8 percent (n=159) disagree or strongly disagree. Over 18 percent (n=71) replied 'depends.' Eighty-five comments are recorded, the most from any single behavioral and preference question. They echo the sentiments found throughout this study: "Depending on the importance of the reading;" "If there is a lot of material, I would prefer printed pages so I don't get a headache from staring at the computer screen for too long. However, I tend to have my laptop everywhere I go and can access my readings everywhere, too;" "It is more convenient economically-wise, but not as helpful for remembering and highlighting/annotating;" "Electronic readings allow me to read them from any device and allow me to search for phrases and topics that would otherwise take me forever to find."

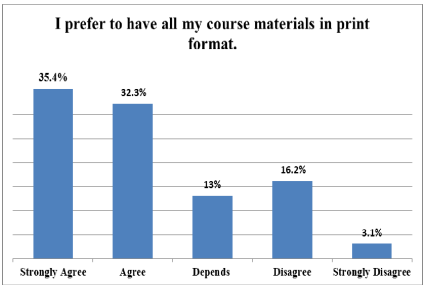

Fig. 1. Responses to question 3

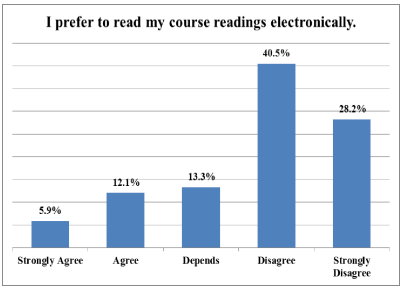

Fig. 2. Responses to question 14

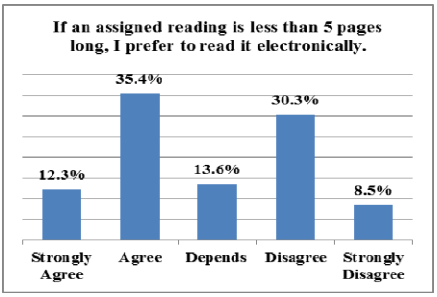

Fig. 3. Responses to question 8

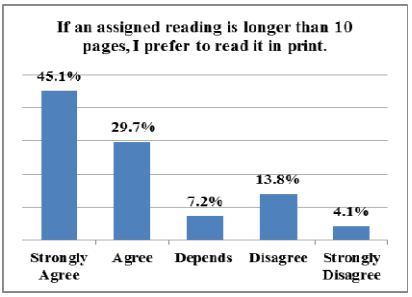

Fig. 4. Responses to question 10

4.2 Learning Engagement

Responses to the five questions on learning factors and behaviors that reflect learning engagement again show preferences for print materials. Figures 5 and 6 illustrate results from Questions 1: *I remember information from my course readings best when I read them from printed pages*; and 13: *I can focus on the material better when I read*

it in print. In both, over 80 percent (n=320, n=319 respectively) agree or strongly agree with the statements.

In the 78 comments from these two statements, students expound upon this idea by again stating that it could depend on the context of the readings, such as importance to the course, length of the reading or personal interest. Five students write in clear favor of electronic format, e.g.: "What helps me remember things is if I can write comments on the text, which most electronic copies will let me do."

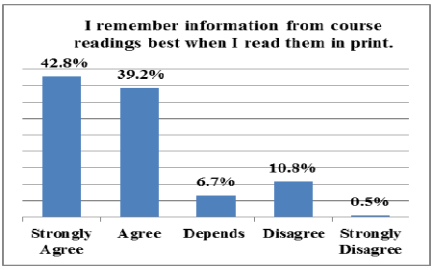

Fig. 5. Remembering best

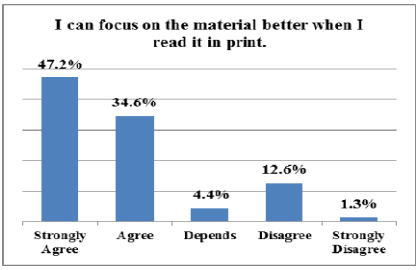

Fig. 6. Focus on material

Over 80 percent of respondents (n=316) agree or strongly agree with Question 7: *"I usually highlight and annotate my print course readings."* Highlighting and annotating while reading is a behavior that demonstrates active engagement with the material in an effort to learn and absorb the information. However, only one third of the respondents (33.6 percent, n=131) agree or strongly agree with the same statement in electronic circumstances: *"I usually highlight and annotate my electronic readings"* (Question 12). Nearly two-thirds (61 percent, n=238) disagree or strongly disagree. Many of the 35 comments indicate that more students would do so if this were possible or they knew how. Often PDFs and other electronic formats do not allow such engagement, or students do not have convenient access to the technologies that enable electronic highlighting and annotating. This circumstance may change as technologies improve.

Question 9: *"I am more likely to review my course readings (after I've read them at least once) when they are in print,"* concerns another behavior that reflects learning engagement. Over 75 percent of the students (n=295) agree or strongly agree with this statement. Some of the 26 comments discuss context and circumstances: "It depends on the length of the reading, how busy I am, and how many other readings I have to do;" or that format did not matter: "I read through both electronic & print, regardless." Others favor one format or the other: "The lack of a find function makes this task harder;" "This [statement] is extremely true for some reason."

4.3 Devices for E-course Readings

All 390 respondents answered Question 16: *"I read my electronic course readings on a ___ (please check all that apply)."* As can be seen in Figure 7 below, almost 90 percent use a laptop for this, followed by phones and iPads/Tablets (27.9 and 26.4 percent).

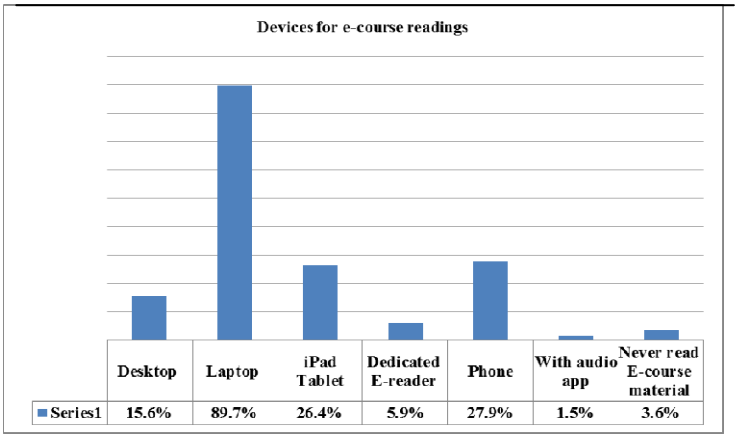

Fig. 7. Devices used for electronic course readings (could be more than one)

The final question is open-ended and generated 112 responses: *"What else would you like us to know about your academic reading format preferences?"* Ninety-three comments (83.04 percent) were coded into one or a combination of the following categories: Both (advantages for both formats); Convenience (of one or the other); Cost (of print); Depends (on context, purpose); Eco (Environment); Eyes (strained by electronic); Prefer Electronic; Prefer print; Tech (comments or issues). The largest category (41.96 percent, n=47) affirms a preference for print but many include the impact of other circumstances, such as cost, convenience, and context in their considerations. Almost 20 percent of the commentators (n=22) affirm a preference for electronic, and 12.5 percent (n=14) mentioned positive aspects of both.

5 Discussion

The majority of the 390 undergraduates in this study, students primarily in their late teens and early twenties, still prefer reading their academic texts in print format when they want to achieve a deep learning outcome. They acknowledge that they comprehend material better when they learn in print format, especially more complex material. Even with technological advances and greater electronic options, students find that print works best for deep learning needs. Reasons for preferring print include:

- tactile aspects of holding, flipping and thumbing through a printed work;
- linear progression as opposed to vertical scrolling;
- better memory cues on printed pages;
- greater inclination to highlight and annotate their printed readings,
- less eyestrain and fatigue

Many instances of format preference however, are driven by the context and circumstance of the material. Clearly the high cost of purchasing books or printing out electronic readings impacts students' behaviors. Many acknowledge that they learn best and prefer print but cannot afford the associated expenses. The importance of a particular reading to the course is another prominent contextual factor – the more important the material, the more likely a student will print it out or prefer it in print, especially if it is dense or complex and demands greater focus. Students also prefer their longer readings in print, especially if it is more than ten pages long. But behaviors vary for shorter texts; some students are okay with reading them online. Others state they are more likely to print the shorter texts than long ones because of cost and environmental reasons.

Students' comments do include reasons for favoring electronic format over print. A small group claims that they do not believe their learning is affected by reading format and they can focus and engage just as well using either. Technological features that allow electronic highlighting and notating lessen the interactive advantage of print, and this factor will likely increase as they become more integrated in e-formats and platforms. Students also describe the electronic find-feature as helpful in their studies. This enables specific word and phrase searches, aiding them with 'pinpoint' reading. But, besides the lower cost, the most prominent theme is the greater convenience of accessing and archiving materials online. Students comment on how much easier it is to have all of the readings for each course on one site, accessible anywhere, than to have to find and assemble or buy the readings on their own. Many also mention the additional drawback of carrying heavy books: "I commute to campus and having physical copies of all the materials is too much weight to carry around all day."

These results not only confirm and enhance the earlier studies described above [7], [8]; they expand upon our current understanding of the concerns and unique considerations our college students face – quality of learning versus convenience and cost of access. These results from a large number of students at a prestigious public university, the currency of this study, and the nature of the information garnered from the responses are also unique among the literature. With the exception of one question about electronic textbooks, the instrument does not ask about specific types of readings – monographs, journal articles, course readers, etc., because with today's technology that distinction is almost artificial to the end user. More distinct is the length, complexity and importance of a text. Readings that are not born digitally can be scanned and posted on a course webpage for easy and free access. Electronic textbooks are becoming more common. Yet there remains an undercurrent of unease with the quality of their learning in electronic formats as expressed by students throughout this study.

This unease appears under-acknowledged today by too many educators, administrators, and even librarians. Studies of the cognitive process of reading, the differences in the various types of reading, and the impact on comprehension of reading electronically or in print must feature more prominently in our decisions to create an educationally and economically feasible balance. It is possible that we are in the midst of an evolutionary transition. As more students who have been e-reading since grade school enter college, and as technology advances, it is possible that the brain's elasticity will enable the development of the necessary deep learning skills in

both formats equally. How will we know if or when the balance of this transition has shifted?

This study looks at a student population in just one North American university, and while the sample distribution by age, majors and years of study is very representative of the UCLA undergraduate population[1], the low response rate could make generalizations problematic. A study of format preferences and behaviors among lower achieving students may generate different results. Much more research is also needed to confirm these findings among students in different types of institutions and learning environments. Students enrolled in online courses face their own unique circumstances, as do their faculty and the librarians trying to support their needs. Continuing to trace the attitudes and behaviors of students as often as every three to five years will help librarians and educators keep up with attitude changes and transitions. The simplicity of the ARQ makes it an ideal instrument for periodical and longitudinal use in institutions and communities and this author invites collaboration on translations for use in other language communities, populations, and environments. Building a network of comparable data will strengthen intelligent decision-making for the ultimate goal of providing the best services to our students and institutions.

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