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Research on Learners' Preferences for Reading From a Printed Text or From a Computer Screen

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Abstract

In this study, 254 Royal Roads University School of Business learners (graduates and undergraduates) were surveyed on their online course-related reading habits and choices. Based on their responses and anecdotal comments and the data from follow-up interviews with six of the participants, learners preferred print copies of text materials for reasons of portability, dependability, flexibility, and ergonomics. Recommendations include providing an option in all online courses to print electronic text files in a format suitable for reading from paper. Further research is proposed on the effect of extended time spent in front of a computer screen on learners' preference for reading from paper.

Résumé

Dans cette étude, 254 étudiants du Royal Roads University School of Business (diplômés et étudiants du premier cycle) ont été interrogés concernant leurs habitudes et choix de lectures relatives au cours en ligne. Selon leurs réponses et commentaires et les données d'entrevues avec six participants, les étudiants ont préféré des copies imprimées des textes pour des motifs de portabilité, de fiabilité, de flexibilité et d'ergonomie. Les recommandations comprennent l'offre d'une option dans tous les cours en ligne d'imprimer les fichiers des textes électroniques en un format acceptable pour lire sur papier. On a aussi proposé des recherches plus complètes sur les effets d'une longue période de temps passée devant un écran d'ordinateur sur les préférences des étudiants de lire sur papier.

Computer technology and software development have made it possible to transfer printed course notes, articles, and textbooks from a paper page to a computer screen so that the quality of the reproduction is ensured, that is, the text is not blurred and the document is easy to navigate. This option would seem to offer the learner the ultimate in choice and flexibility.

However, researchers still lack information on "how readers actually engage with these different formats of digital text vs. printed text, their reasons for choosing one format over another, and the different values and satisfactions they assign to reading each" (Ross, 2002, p. 4). Hence learners' course-related reading preferences are the focus of this study.

Rationale

At Royal Roads University (RRU), graduate and undergraduate degree programs and diplomas are offered in a combination of short residency periods and distance learning courses. The RRU business model requires that course materials be distributed by the most cost effective method. In the RRU School of Business, MBA courses and most BCom courses currently distribute either a binder or a shrink-wrapped package containing a printed course overview and instruction units as well as third-party readings to complement the online activities and assignments and duplicate the online course notes. Because most RRU distributed learning courses are offered via the Internet, university administrators questioned the need to incur the shipping costs necessary to provide learners with printed course materials.

Copyright clearance for third-party readings scanned onto the Web site is becoming increasingly acceptable to most publishers, but cost remains a stumbling block to providing electronic versions of all required readings in a course. At present, printed paper reproductions are often cheaper due to the low per-page fee charged for copying under the University's Access Copyright license (covering about 63% of all university print reproduction). Based on data from 19 publishers worldwide, a single digitized reading costs on average three times more than the same reading in print (M. Martens, personal communication August 23, 2003). However, due to the scale and type of content provided, printing and distribution of paper readings to the university's globally dispersed learners adds another $10-30 per readings package (more for overseas learners, B. Fraser, personal communication, March 1, 2004).

For environmental reasons many instructors and program departments are anxious to avoid unnecessary use of paper and other manufactured products such as binders. They often request that their entire course content (including readings and when possible textbooks) be made available to learners solely in an electronic format.

However, in moving to an all-electronic delivery of our courses, do we as a learner-centered institution do a disservice to our learners? Are we just transferring the cost and inconvenience of printing course materials to the learners, or are learners in fact comfortable with reading and studying the materials from their computer screens or other electronic devices? Do learners accept the choice of printing sections of their course materials for themselves? Addressing these questions will help the university make informed decisions about the design and delivery of curriculum and supporting resources.

Associated Literature

Most research on learners reading from text or screen have focused on learner action. However, learners' preference is distinctly different from learners' action. A learner may read both from paper and from a computer screen, but still prefer one method over another. Often the choice of one or the other is unavailable. More often learners perceive an impediment to choosing their preferred method ("The online reading I would prefer to read is only available in a very small font," or "The paper reading I would prefer to read is at home on my desk"). In the future, when most of the limitations will be overcome, it will be critical to understand learners' preferences before committing energy and resources to a particular technology.

Northrup (2002) investigated the types of interaction students perceived as important for e-learning and claims that the evidence collected from an analysis of quantitative data confirmed the importance of interactive elements in online learning. She divided interaction attributes into four categories: content interaction, collaboration and conversation, intrapersonal or metacognitive strategies, and support, and surveyed 52 learners in an online master's program in instructional technology (which could indicate an introduced bias toward using online technologies) about these attributes. The highest reported perceptions of positive interaction were in the areas of audio-narrated presentations, and reading text followed by a discussion. This would suggest that reading text is still part of the preferred content delivery of online learners. Learners were not asked whether they read the text as it was presented on the screen or chose to print it first.

August, Hurtado, Wimsatt, and Dey (2002) suggest that there is benefit in "understanding more clearly how students and teaching faculty perceive their roles in, and engagement with the teaching/learning environment" (p. 3). Although their study more accurately compares student perceptions of their learning with faculty self-perceptions of their ability to employ new pedagogies in their classroom, the study underscores the importance of ongoing investigative dialogues with students in an attempt to maximize their learning experience.

Cragg, Andrusyszyn, and Humbert (1999 examined students' experience with technology and preferences for distance education delivery methods in a nurse practitioner program. Eighty-six learners completed an extensive 23-page questionnaire, and six learners were randomly selected from that group for a follow-up interview. Survey results showed that print-based materials had a significantly higher mean rating than all other delivery materials and that learners changed formats (e.g., video to audiotape) to suit their circumstances. The researchers concluded that

although print was most often preferred, a variety of delivery methods was indicated in order to satisfy all learning strategies and learning styles.

In 1999, as part of a larger study, Collett (1999) and his colleagues analyzed the factors that influenced learners' decisions to print rather than read from the screen. They surveyed 40 undergraduate or graduate adult education students and found that "learners print the web pages for a variety of reasons, irrespective of web page length" (p. R-156). The main reasons for this behavior were the belief that the content might be useful at a later date or that there was a need to make notes on the article. Conferencing threads were most often printed for the same reason: it might be useful at a later date or because the learner believed that reading on paper enhanced comprehension. They also found that learners desired text-based support (i.e., transcripts or notes) for audio- and videoconferences.

In a comparison study of campus-based and distance learners, Armatus, Holt, and Rice (2003) included a question about the learners' preferred method for studying. Learners in both groups overwhelmingly endorsed print materials. In this study of LMS (Learning Management System) use, however, no differences in preferences for a variety of learning tools were attributed to a difference in the age of the participants, yet the age at which someone adopts reading from a computer screen may be one factor that influences learners' preference.

Also in 2003, the Centre for Academic Excellence and Innovation at the University of Ontario Institute of Technology surveyed their first-year nursing and commerce students (Muirhead, 2003). Two questions related to learners' comfort reading academic text online. Most learners indicated that they found reading an academic article online "tiresome" or "very tiresome," and most said that they would not feel comfortable reading an academic article of more than four pages online.

Although these studies suggest learners' preference for printed text, several questions remain: does familiarity or purpose make a difference; does age or eyesight make a difference; does experience with computers make a difference?

The research questions asked for this study were:

1. By what method (online or print) are text-based course notes most often read by learners currently participating in School of Business programs at RRU?
2. How do factors such as age, eyesight, and comfort with computer technology affect learners' preferences for course reading material?
3. What implications do these findings have for the most effective distribution of course materials to RRU learners?

Method

My process of inquiry employed a combination of an online survey of 500 undergraduate and graduate students and six selected telephone interviews to obtain more detailed information about their online and print reading habits and preferences.

Garton, Haythornthwaite, and Wellman (1999) suggest that electronic data gathering may be better for measuring actual use than for gathering perceptions of media use. Therefore, my questionnaire contained several closed questions about whether the learner read mostly from a printed page or from a computer screen during their most recent course. Garton et al. cite an earlier work by Rogers (1987), who noted that "most network researchers agree that the best approach (to collecting data) is to use a combination of methods, including questionnaires, interviews, observation, and artifacts" (p. 91).

Mann and Stewart (2000) suggest that structured interviews are useful for qualitative researchers when "focused and specific contextual information is required and cost, time, reach (possible range of context) and/or anonymity are an issue" (p. 71). With the advantage of the availability of an established online survey tool that my participants had used previously to complete a number of other questionnaires, I was able to ensure an acceptable level of accessibility and prevent the poor response rates experienced in many online surveys.

Learners have their own perceptions of reality and ways of constructing knowledge (Creswell, 1998). For this reason, it was important to interview a range of participants to provide personal descriptions of use and reasons why survey participants held these particular preferences.

The survey and subsequent interviews were conducted under the aegis of the RRU Research Ethics Policy and with the prior approval of the RRU Ethics Board.

The survey was offered to all learners enrolled in the 2003 and 2004 MBA programs and all learners enrolled in the 2003 BCom online program.

All participants in the study had used the online survey tool previously in order to complete course feedback surveys, so the technology should not have affected the level or quality of responses. The survey was available for completion for 13 days from May 28 to June 9, 2004.

The follow-up interviewees were randomly chosen (every third name) from those participants who voluntarily e-mailed their consent to be interviewed.

The survey was a 22-question form completed online with our in-house survey tool. It began with nine background questions in a multiple-choice format. The remainder of the questions used a 4-point Likert scale (generally, sometimes, always, never) or a *choose all that apply* format. All

responses were completed by clicking on the desired box or boxes; an option for additional comments was also provided and used by 61% of respondents. The survey questions were laddered (Price, 2002) to build from basic action questions (what do you do?), to knowledge questions (why do you do this?), to questions of philosophy (why do you think you make these choices?) to end with an action question to bring the participant back to an area of comfort.

I pilot-tested my questionnaire on several volunteer staff members who are also, or have recently been, university students. To test the internal validity of the survey, I asked the pilot volunteers to complete the questionnaire twice over a period of time in order to ensure that the questions elicited consistent responses (Locke, Silverman, & Spirduso, 1998).

Responses were automatically made anonymous by the survey tool and recorded in a database accessible to the survey creator (the researcher).

The raw data from the survey was published to a School of Business Web page so that the participants could see the results.

Response Rate

Of the 500 respondents asked to complete the survey, 254 learners completed the online survey. Fifty-two percent of the approximately 400 learners enrolled in either the first or second year of the MBA completed the survey. Approximately 100 learners enrolled in either the first or second year of their BCom were asked to complete the same survey, and 45 responded (45%). Approximately half of the undergraduate and graduate respondents were female.

For the focus interviews, the chosen participants were contacted by e-mail and asked to participate in a brief telephone interview. In order to allow them time to reflect and prepare for the interview, the e-mail request explained that the intent of the follow-up interview was to find out more about why they may have given the answers they did. The interviews were semistructured and conversational; in order to gain the participants' confidence, I worked from a prepared concept of the laddering process, asking safer action-related questions first before moving to questions of knowledge and philosophy. I took notes during the telephone conversation. The portions of the interviews that I chose to use were sent to the participant via e-mail for his or her verification before writing up the study. Their e-mailed consent was printed and filed with the interview notes and then deleted from the computer.

Findings

Due to the emergent design of the research tools, the categories in this section were arrived at after analysis of the survey data, and these findings were then used to guide and inform the follow-up interviews with six selected volunteers from the original survey group.

Of the respondents, 45% indicated that they had been reading multiple pages of text online for more than five years, and 29% had been reading online between one and five years before taking a course at RRU.

Age and Reading Online

Although each successive generation has clocked more time using computers for business, personal, and educational purposes, there is not yet an adult population that has learned to read and study exclusively in an online environment. Some literacy theorists contend that just as we once moved from an oral tradition to a literate one with its dependence on alphabetic linear text, we are now shifting to a new, as yet not fully understood paradigm of heuristic communication with its nonlinear collage of letters, symbols, graphics, and pictures (Ulmer, 1998).

This view of the future has led to the widespread belief that younger generations will embrace the computer such that the result will be the demise of the printed book and its variations. Coupled with another popular conception that the older people get, the more difficult it becomes for them to change their habits, the survey might have been expected to show a marked difference in learners' preference for reading online between the age categories. Some of the survey respondents themselves expressed this belief.

"As you can see from my age, I am having trouble adapting to total online lessons," commented one learner (# 143), whereas another noted, "I would be curious about the results, specifically if learners my age and older prefer written text" (# 191).

The average age of survey respondents (35-39) reflects RRU enrollment statistics and a stated focus on mid-life learners because 83% of the respondents were between the ages of 30 and 49.

Although the number of respondents at the extreme ends of the age grouping were small, and therefore may not be statistically representative of their age groups, the results were similar for both the younger and older age groups in the study, with 73% of surveyed learners under the age of 30 and 78% of surveyed learners over the age of 50 choosing to read less than 50% of their printed text online.

Vision and Reading Online

Since computers became ubiquitous in modern offices, video display terminals have been the subject of many investigations. Their negative effect

on health, especially eyesight, has led to the development of new types of screens and the recommendation by physicians to limit the numbers of hours spent in front of a computer screen each day (Balci & Aghazadeh, 2003). Although a question in the survey asked learners if they wore corrective lenses for computer reading (54% answered Yes), the most interesting finding was in the anecdotal comments—26 learners of varying ages, half of them without corrective lenses, said they found extended reading from a screen hurt their eyes or gave them headaches. One man in his mid-30s said, "I spend an entire day looking at a computer screen at work, and then do it in the evenings and weekends as well … in fact, I know that my eyesight prescription has changed in the 14 months since I started the MBA" (# 55).

Of those who responded, a greater percentage of women (59%) than men (46%) required corrective lenses for reading. It may be that people with poor or corrected vision have additional problems with screen glare and eye fatigue, but this would have to be investigated further. In this survey, there did not appear to be a direct correlation between poor eyesight and concern over eyestrain when viewing text on a computer screen. A comparison of the voluntary comments about eyestrain with learners' need for or lack of corrective lenses provided inconclusive results. "Reading on screen has made my eyes deteriorate rapidly. I've had to get glasses because of the computer and would prefer easy-to-read documents and ALL course notes in printed form, mailed to us," commented one learner (# 168).

Screen Quality

The design of the printed page has been perfected through years of experience, research, and technological advances in the printing process. Nevertheless, most people have experienced some form of eye fatigue or irritation when reading from a printed page for extended periods of time. The relative newness of screen reading has its own set of viewing problems including glare, resolution, limitations in screen size, and spatial and relationship challenges.

Advances in screen technology may address the issues of flicker rate and portability that current literature indicates as possible impediments to reading large amounts of text from a computer screen. Research suggests that the refresh rates, fluctuating luminance, and contrast levels in cathode-ray tube monitors may affect cognition rates. Garland and Noyes (2004) conducted a series of study and test sessions that monitored users reading the same material from a screen and from paper. They discovered that how knowledge was retrieved varied between the presentational formats and that screen reading was slower and possibly less accurate than reading from paper. The researchers concluded that the monitor itself

might have caused cognitive interference. They surmised that the development of LCD and plasma screens might mitigate this limitation once they were in wider use.

However, 64% of School of Business learners participating in this study are already using the new screen technologies.

When asked what type of device they used most often to access their online courses, 52% responded that they used a standard desktop PC, and 45% used a laptop. This was also reflected in their response to the question "What type of monitor is attached to your most often used computer equipment?" 38% used an LCD monitor (common on laptops), whereas 38% had a VDT monitor (common on PCs), and 27% indicated that they used a flat-screen monitor.

In addition, the equipment being used was current technology. Most respondents owned computers that were between one and three years old (54%) or newer (29%), and most respondents were using a recent Windows operating system (Windows XP: 68%).

> I do not think computers are necessarily healthy, there is definite eye strain and we don't know what they may be emitting—definitely a day in front of the computer is more tiring than a day reading paper.… For those learners who may spend a large part of their day in front of the computer at work, to have to do so for reading text purposes for their course (when they get home at night) is less than appealing. (# 23)

Printing or Reading Online

The series of questions about whether learners read various text-based portions of their course material from the computer screen or from a

Table 1
Participants' Preference for Reading on Screen and on Paper

Material Type	*Always*	*Generally*	*Sometimes*	*Never*
Course Notes				
Screen	6	19	149	77
Print	130	77	45	1
Readings				
Screen	16	36	148	52
Print	71	69	95	16
Schedule and Assignments				
Screen	38	58	126	30
Print	75	61	93	22

(number of respondents) *N*=254.

printed page yielded varying results depending on what they were reading (Table 1).

As shown in Table 1, approximately 10% of learners read their course notes on screen on a consistent basis (always, generally), and 20% regularly read their library readings thus. However, short and immediate pieces of information such as schedule dates and assignment descriptions were read online by 53% of the learners.

There was a majority practice of reading course notes on paper, but it was a less significant majority when it came to reading other materials such as articles and schedules on paper:

The reasons for these differences might be deduced from their answers to when they would choose to print an onscreen or electronically available text item:

- 92% printed the item when they needed to work concurrently on other documents;
- 82% printed an article if it was long or complicated;
- 80% printed material when they needed to study it in preparation for an exam or assignment; and
- 75% printed if they needed to take notes.

The additional choices given—time, reliability of equipment, quality of online text reproduction, or number of graphics and tables—were not considered to require print copies by most of the respondents.

The survey shows that learners in current School of Business online courses read most of their content from a printed page and expect to continue to do so regardless of new developments in technology. In terms of their actual practice, 67% of all respondents read less than 30% of the available text-based content from the computer screen during their most recently completed course. Individual interviews sought to clarify why this decision was made, but it remained largely for the same reasons mentioned above: ergonomic or eyestrain problems; the need to annotate and highlight; the need for maximum portability; and the need to spread out materials. As one learner put it,

> I'm studying right now and I have my text book open beside me and my printed course notes and some other materials on the other side of me and I am typing into my computer. This is much easier and faster than flipping back and forth between screens and I don't lose my place as easily. (# 2-2)

In the comments area of the survey, on the issue of preference for reading on screen or from a printed page:

- 29% of those whose chose to comment cited portability of paper copies for the reason they preferred paper;
- 27% cited ergonomic concerns (especially eyestrain); and

- 27% mentioned the need to highlight and annotate text materials.

Many of the same respondents mentioned some or all of these concerns.

Given the above result, the question becomes whether technology will be able to overcome the limitations perceived by the learners. In follow-up interviews, I sought to discover whether learners knew about technologies that provide the ability to annotate text online, about new screens that had lower flicker rates and less glare, and about the new lightweight laptops and other handheld devices. Most of the participants were familiar with these technologies, and some already used them, but they all remained unconvinced that these products (even if they were provided to them) would substantially change their preference for printing some or all of their materials on paper.

Because the questions about preference for on-screen or print reading were asked about typical course experiences, a follow-up survey question sought to have the learners focus specifically on their actions in their most recent course. Here the response was conclusive. In order to ascertain actual practice rather than preference, learners were asked to estimate what percentage of their course content in their most recently completed online course they chose to read online even though it was also available in print. Most respondents (67%) read less than 30% of their course material online when provided with a printed alternative, whereas 26% claimed to read from 0-10% of their material online.

In the follow-up interviews, learners who indicated that they read very little on screen were asked if they would then prefer to have all materials in print and just go online for class discussions, e-mail, and other interactive events (similar to an earlier model of course delivery used at RRU). The learners all felt that having the text materials (notes and readings) available in both media was their preferred course design. Although they expected seldom to access the print material electronically, they liked the convenience of having it in two formats.

A follow-up interview question sought to discover whether the learners would still require a print copy of material presented to them on-screen in a nontext (i.e., audio or video) format. The participants in interviews cited an accounting CD of lecture material they had all experienced (it is used in both BCom and MBA programs), with two participants suggesting that it was similar to paper in terms of convenience in that it could be used offline and could be easily reviewed repeatedly. The other four participants saw it as supplemental material only, not something they used extensively, and therefore not a substitute for printed material.

"I don't see audio or video as a replacement for text, I would still want a printed version for note-taking," said one learner (# 2-2).

Another learner said, "Video and audio are okay as 'extras': but I still prefer paper—it is easier and faster to move ahead or go back in the material" (# 2-1)

Reading, Tactile Satisfaction, and Reassurance

The survey data, including the voluntary comments, suggested that learners most often preferred to print their text material for pragmatic reasons (portability, reliability, flexibility). Because computer technologies will continue to evolve and become more portable, more reliable, and ultimately more flexible, it was important to try to discover if there might also be other reasons for the learners' preference for printed material.

In the survey comments field, one learner said, "I have used the ebook type tablet and found it to be a good medium [but] I enjoy the tactile experience of books and paper" (# 192). Another commented, "I like paper, it feels and can be more permanent. Paper allows me to be more spontaneous in forming thoughts" (# 162). "As much as I try, I cannot seem to make the transition to reading on the computer. There is something familiar and comforting about holding the information in your hand, marking it up, and making it your own," said another (# 151).

In the follow-up interviews, all six participants interviewed started by indicating that their preference was for reading from paper, but their subsequent description of what this meant varied widely. Some preferred reading virtually everything from a printed page, whereas others preferred print only when readings were lengthy or complicated. The age of the follow-up group ranged from 32 to 48 years, and at both ends of the range the participants made reference to their belief that a younger generation might do things differently.

In the follow-up interview group, there was consensus on the need to have paper documents because of the reliability of this medium. "I like to print almost everything so I have a hard-copy reference for later," said a 37-year-old graduate student (# 2-6). Even the participant who indicated that he would ideally prefer everything except textbooks (where the expectation is that the entire book will be read) be online, said he would "probably have paid for printed course materials when first starting at RRU until I was confident that the Web site was stable" (# 2-3).

Being able to hold the text material physically in their hands appeared to give learners a measure of security, as they expressed concerns about losing data because of low batteries or poor connectivity. One learner used paper documents as a visual representation of workload.

> The course workload seems more manageable if I can hold it in my hands. If I can literally "see" how much material there is, I have an idea what I am getting into. On the Web site, I have difficulty assessing the workload

because I cannot see how deep it goes. There is also the fear that I might have missed some of the material on the computer. (# 2-4)

Marking Documents

The desire to highlight and annotate readings is known to be a preference of many online readers (O'Hara, Smith, Newman, & Sellen, 1998). As a result, a number of available software products make it possible to mark up documents and make notes. It appeared from the survey comments that many of the participants were largely unaware of the availability of these products, providing statements like "I read with a highlighter. Can't do that online" (# 149).

In the follow-up interviews, the participants were asked, "If you had software that made it easier to take notes, highlight, and annotate documents online, would you read more online?" Although some interview participants said they would try it, all indicated that it would probably not change their habit of printing out materials. As one of the learners put it, "I probably wouldn't bother, because I am trying to keep things simple. I might use it if I was required to use it at work though, because then it would be worthwhile to learn" (# 2-3). Another said, "I work the way I learned to study—using paper. Maybe a new generation who learns to study online will not need to have any paper copies" (# 2-4).

Although annotation and highlighting on screen would add to the convenience of reading an onscreen document, other factors such as eye fatigue and concerns about computer reliability seemed to prevent this from being a simple solution to issues of reading from a computer screen.

Cognition and Reading Online

A Sun Microsystems comparison of online reading with paper-based reading showed screen reading to be about 50% slower than reading from paper (Mitternight, 1998). Critics of this type of research suggest that the tests being used evaluate reading ability in a linear environment and are incorrectly applied to reading in a hypertext (nonlinear) environment. Still others (McHoul & Roe, 1996) criticize any analytical attempts to measure reading cognition, suggesting that it is too variable to be measured or quantified.

Although this survey did not attempt to assess learners' cognition rates when reading on screen compared with reading from a printed page, some learners suspected that their retention rate suffered when reading from the computer screen. One learner said, "I find it far harder to absorb information from a screen than from paper" (# 138), whereas another noted, "It's very hard to read online, I only use it to skim read" (# 216). A third participant extended these ideas.

> In general, I find it easier to read and understand text when read on paper. This is especially true if the text is long or does not flow very well. I like the ease of finding and reading text on a computer but it is not always my first choice if I really need to retain what I am reading. (# 207)

Although still an area of controversy and continued research, the learners' comments in this study seem to support investigations that indicate that screen reading is slower and possibly less accurate than reading from paper and that online presentation yields a greater short-term storage of information, but less of the information is transferred to long-term memory (Duffy, 1987; Garland & Noyes, 2004).

Online and Offline Reading

One issue of access that affects the decision whether to read on-screen or in print is the restrictions of less powerful computer devices such as laptops and PDAs. These devices are not always able to supply enough power to remain online for long periods and therefore require that any extensive reading material must be available in a format that will allow it to be downloaded and read without being connected to the Internet. This same limitation faces those learners in remote areas of Canada or other countries where only costly and unreliable dial-up connections are available. As a result, some learners felt forced to print out their reading materials because some assigned material (such as a reading on an external Web site) was unavailable in an electronically downloadable format.

> There is quite a difference between online and electronic format. Online is not portable—I can't take it to the beach with me, or out to the coffee shoppe [sic]. I think a portable format is much more useful than just online for text that requires more than one screen, meaning it cannot be saved in a single file (# 136).

Learners were asked to indicate all the various types of computer equipment they owned or to which they had regular access. In addition to laptops and PCs, 35% of learners indicated that they owned or had regular access to a handheld device such as a PDA or Blackberry™, and 27% indicated that they owned or had regular access to a cell phone with Internet access. The use of these devices for reading text may affect learners' preference because the screens are smaller and most text content was not developed with this format in mind.

The Future of Reading Text

Learners' perspectives and philosophies about learning materials and technology in the context of reading text were sought in the survey with a question about the future.

When asked if future (unspecified) advances in computer technology would change how they interacted with text materials, 71% of respondents believed that they would have more choice in how they accessed materials, and 59% believed that advances in computer technology would have no effect on their current preference for reading from a screen or from a printed page. Only 5% of respondents thought conventional books, magazines, and newspapers would become obsolete, and only 2% thought that future computer advances would completely replace the need to read text in any format (online or paper). However, a total of 29% of the learners thought that computer advances would reduce the frequency with which they found it necessary to print online text materials.

Comfort with technology and adequate software training may not have a large effect on learners' preferences to read text from a printed page. Many learners indicated that annotating and highlighting requirements caused them to print their course notes. However, the ability to do these activities online has existed for some time, and even a controlled document in PDF format can be annotated and highlighted with Adobe Acrobat software. A product like Windows XP Tablet PC Edition expands the Windows XP Professional platform to enable users to make notes in their own handwriting or add "sticky notes" to files. Those participating in the follow-up interviews did not believe that the wider availability and acceptance of these or other software tools would change their preference to read and annotate on a paper copy.

Limitations of the Study

Although current learners' preferences can be demonstrated by this study, further data will need to be gathered on a regular basis as time, generational differences, and refinements and advances in technology will probably result in changes in learners' preferences. Another limitation is the limited scope of the study itself. The study participants came from a single school in a single institution. The study looks only at the preferences of these learners for using a particular medium for a particular task (reading text).

In addition, the survey instrument itself is subject to criticism by researchers because, "Data about people's actual behavior should have precedence over people's claims of what they think they do. People rationalize their own experience" (Nielsen, 1999, para. 3). Nielsen and others would prefer to gather observational data such as the statistics on the viewing of course content pages available on platforms such as WebCT and record the number of times a learner then chooses to print that page.

The relatively low response rates for the *always* or *never* categories in the questions about whether the learner chose to print or read on-screen suggests some ambiguity. In the comments provided, some learners sug-

gested that the choice of whether to print was hampered by confusing or inconsistent course design or by the use of copyright-protected PDFs that are difficult to navigate online. They indicated that this situation led to their choice of the *sometimes* or *generally* responses even though all things being equal, their preference would have been to read everything online.

Several learners found the Likert selections *generally* and *sometimes* confusing and indicated that they were unable to decide which most accurately reflected their experience. The scale (*generally*, *sometimes*, *always*, *never*) was not in a clear increasing or decreasing order.

At the time of this survey, one class of 75 MBA learners who had been asked to participate in this study was involved in an online course that had not provided the back-up version of the course notes in print: an expectation of these learners based on their previous course experiences at RRU. Because of the anonymity of the survey, it cannot be determined how many of the learners from this particular course participated in the survey, but based on the comments included in the survey some of their anger about a perceived change in policy may have led them to indicate more strongly their preference for printed materials for fear that a change in university policy was about to take place.

None of the participants in the follow-up interviews indicated that they had altered their survey responses in reaction to these paperless courses. Nevertheless, the issue was also apparent in the follow-up interviews, where participants were hesitant to answer a question about whether they would pay for an optional printed package, expressing the concern that their response might cause the School of Business to stop providing them with printed course material. The participants all agreed that they would probably pay for a printed package if it was not supplied, but felt that in the current circumstances, RRU had committed to providing this material as part of the cost of the program.

Study Conclusions

My research supports the findings of other researchers who have sought to discover preferences for print or onscreen reading among business people (Sellen & Murphy, 2002) and those who asked related questions in surveys of learners (Cragg, Andrusyszyn, & Humbert, 1999). The convenience of paper for reasons of portability, reliability, annotation, highlighting, and ergonomics consistently made it the preferred form for printed text. Even those who fully embraced the new technologies and rarely printed their text material indicated their desire to have the option of print available to them for reasons of convenience. For these people, traveling and busy schedules meant that they often found themselves in locations where connectivity was unavailable or with short windows of reading opportu-

nity in which it was faster to access a paper than locate something on their PDA or laptop. One learner said,

> I do at least five to 10 hours of reading (about 80% of my course requirements) a week on public transit or on the plane. I cannot read on the bus with my computer, and booting up the computer on the plane is cumbersome and time is wasted during landing and take off. (# 211)

"I read my notes at the gym, in the car waiting to pick up the kids, at a soccer game, etc.—the paper version is very helpful for this," said another (# 29).

Although preferences may change with succeeding generations and with new technological developments, in the meantime, it is imperative that course developers and designers keep in mind such situations that sustain this preference for reading text from a printed page. The best possible course delivery for these learners includes providing an option to print electronic text files in a format suitable for reading from paper.

Future Research

Areas for further study raised by the literature review, survey results, and follow-up interviews include issues of gender and time.

The effect of a person's sex on reading preference was not fully explored. Although the data are available in the study, further qualitative research into this area would be desirable before any conclusions could be reached.

Many learners referred to the length of time they spent in front of a computer screen each day as a factor in why they printed their course materials. It would be useful to investigate this as a potential influence on course design for adult learners.

The evolving designs of small mobile devices that can be used to read text will benefit from additional research into the type of content learners prefer to read on these devices.

This project added to the small body of research into learners' preferences for reading text from a screen or from a printed page. It points to the value of researching learners' preferences for educational technologies as an adjunct to the assessment of the pedagogical value of these technologies.

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