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Print versus digital reading preferences of university students in Australia

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Abstract:

This paper presents findings of a survey that investigated the reading preferences of university students at Edith Cowan University (ECU) in Perth, Australia. This survey is being undertaken as part of the Academic Reading Format International Study (ARFIS), which is investigating print versus digital reading preferences in 31 countries. A total of 582 students completed the survey. Results from the survey indicate a strong preference for reading in print because of issues such as eyestrain, tactile features, better focus, and ability to highlight and take notes. Issues such as cost, usability and accessibility also impacted on students' reading decisions.



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Introduction

This paper presents findings of a study that investigated the reading preferences and behaviours of university students at one university in Australia. The study involved conducting a survey of the print versus digital preferences of undergraduate and postgraduate students at Edith Cowan University in Perth, Australia. Edith Cowan University serves over 27,000 undergraduate and graduate students across a range of disciplines and has both on and off campus students. This survey was undertaken as part of the larger Academic Reading Format International Study (ARFIS) that is investigating print versus digital reading preferences in 31 countries. ARFIS was started by a group of librarians and academics based on the original work of Mizrachi (2015). Results of ARFIS so far in 21 countries with over 10,000 students have indicated that most students acknowledge that print works best for learning and still prefer reading their academic texts in print format (Mizrachi et al., 2016). University libraries are increasingly following collection development policies with a preference to purchase electronic materials over print materials, therefore it is important to gauge the students' preferences of print versus digital texts as well as their satisfaction with the usability of e-books and e-readings.

Literature Review

Results of several recent surveys conducted as part of the Academic Reading Format International Study (ARFIS) indicated that most students feel that print helps them to learn better and prefer reading their academic texts in print format. A majority of students also preferred to print their class readings (Boustany, 2015; Kortelainen, 2015; Zabukovec & Vilar, 2015). In a study conducted with 400 undergraduate students at the University of California, Mizrachi (2015) found that, overwhelmingly, the students preferred print over electronic formats for learning purposes. The students' reasons for preferring print included that print caused less eyestrain, the advantages of the tactile aspects of print, and that they were more inclined to highlight and make notes with print readings. Mizrachi also found that multiple factors such as accessibility, cost, and complexity of the readings had an effect on their reading behaviours. These studies differ in their conclusions from others, which have found students self-report a preference for electronic reading. Singer and Alexander (2017a) found in their study of 90 University students that the participants expressed a preference for electronic reading for several different types of tasks such as newspaper and magazine reading. Other studies suggest reasons for this disparity. Foasberg (2014) conducted a study with seventeen students across all year levels at Queens College, New York where she asked students to record information about their reading practices for twelve days in a diary. She found that students tended to use print for academic and long form reading and to engage with it more deeply, and that students often used the electronic medium for shorter and non-academic reading. The nature of the reading material type and task is likely related to preference and influences the findings of these past studies of user self-reported preferences.

Beyond self-reported preferences, studies have also been conducted on the impact of reading comprehension when reading in print or digital format. A study conducted with 92 second-year college students from one university in Beijing, China, found that students who read with paper performed significantly better than students reading on computers when it came to shallow level comprehension (Chenet et al., 2014). They also found that familiarity with electronic devices such as tablets resulted in more deep reading comprehension, leading them to conclude that electronic reading comprehension can be improved if you provided training to students on how to use electronic devices. Despite device familiarity having an impact on reading comprehension, students still preferred reading in print over electronically. Another study on college students found that medium may not impact reading comprehension when students are engaged in more simple tasks, but that the medium may have more impact on reading comprehension when it comes to more complex tasks (Subrahmanyam et al., 2013). They suggest that students may need to multitask and be strategic about choosing which medium to use when reading for more cognitively challenging tasks. Berg, Hoffman, and Dawson (2010) also found in their usability study of print and e-books that the 20 undergraduate students in the study appeared to understand the conventions of print books, but were unclear about the functionality of e-books when it came to information retrieval. A study of 91 students at a university found that previous use of e-books did not have an impact on the students' preference to read in print for learning. The study also found that students were more likely to use special features such as reading captions and charts and answering study questions in print books than in e-books (Woody et al., 2010). In their systematic review of the literature concerning the impacts of medium on reading comprehension, Singer and Alexander (2017b) suggest based on the available empirical evidence that certain features of e-text, such as scrolling, increase cognitive demands on readers and lower resulting text comprehension, and that the nature of the reading tasks and type of material interact with the medium to influence both user preference and comprehension.

Method

Data Collection

The study involved gathering data from a survey of the print versus digital preferences of students at one university in Australia. This survey was undertaken as part of the larger Academic Reading Format International Study (ARFIS) that is investigating print versus digital reading preferences in 31 countries. Surveys were sent to all 24,790 undergraduate and postgraduate students at ECU in April 2017, after receiving ethics approval. The survey was only sent once and there were no follow-up emails asking students to participate. The ARFIS questionnaire consists of 17 Likert-style statements on academic reading behaviours and preferences, six demographic questions, and an open prompt for any further information. Questions in the survey aimed to gauge the print and digital reading preferences including whether factors such as length of text and language impacted their preferences. The survey was sent using the Lime survey tool.

Data Analysis

Ordinal Likert data from participants was combined and analysed using SPSS. Question responses from the ARFIS instrument were combined to provide a single score for separate dimensions. Data was analysed twice: once after combining Likert items by summing them for each participant, and once after combining Likert items by calculating mean responses for each participant. This was intended to increase confidence in the validity of the conclusions. Results, including statistically significant correlations and effect sizes from each mode of analysis were very similar and therefore the analysis from summed responses is presented here. The following table details which instrument items were combined into the dimensions presented in the results section.

“Preference for Print” dimension consists of the following items:

- I remember information from my course readings best when I read them from printed pages
- I prefer to have all my course materials in print format (e.g. book, course reader, handouts)
- I can focus on the material better when I read it in print

“Preference for Electronic” dimension consists of the following items

- I prefer electronic textbooks over print textbooks
- I prefer to read my course readings electronically

“Learning Engagement with Print” dimension consists of the following items:

- I usually highlight and notate my printed course readings
- I am more likely to review my course readings (after I've read them at least once) when they are in print

“Learning engagement with Electronic” consists of the following items:

- I usually highlight and annotate my electronic readings

Demographic and response data was analysed using non-parametric Mann Whitney U and Kruskal-Wallis H tests for establishing correlations among participant response patterns and distributions and calculating effect sizes for those correlations.

Results

Demographics

A total of 582 (2%) of students who were sent the survey fully completed the survey. The survey was sent once to all students (24,790) enrolled at ECU. The majority of students who completed the survey were female. 443 (76%) of the respondents were female with 134 (23%) of respondents being male. Two (1%) of the respondents identified as other. As shown in Figure 1, the largest age group to respond was students aged 40+ with 190 (33%) responses, followed by the 20-24 age group, 102 (17%), closely followed by the 25-29 age group with 90 (15%) responses. The other three age groups all averaged around the same number of responses averaging between 10-12% of the responses. A range of different year levels responded to the survey. As shown in Figure 2, the biggest group of students to reply to the survey were first years with 145 (25%) respondents followed by Masters students with 128 (22%) responses, with the third largest group to respond being second year students with 100 (17%) responses. Students were also asked what major they were studying and in what mode they were studying. The answers for the major the students were studying was categorised into three subject areas. The majority of the respondents were studying a Social Sciences major with 370 (64%) responses, followed by Science with 118 (20%) of the responses and Arts with 50 (9%) of the responses. 44 (7%) students left this answer blank. The majority of students who responded to the survey were on campus students with 343 (58%) of the responses followed by off campus students with 145 (24%) responses and finally 107 (18%).

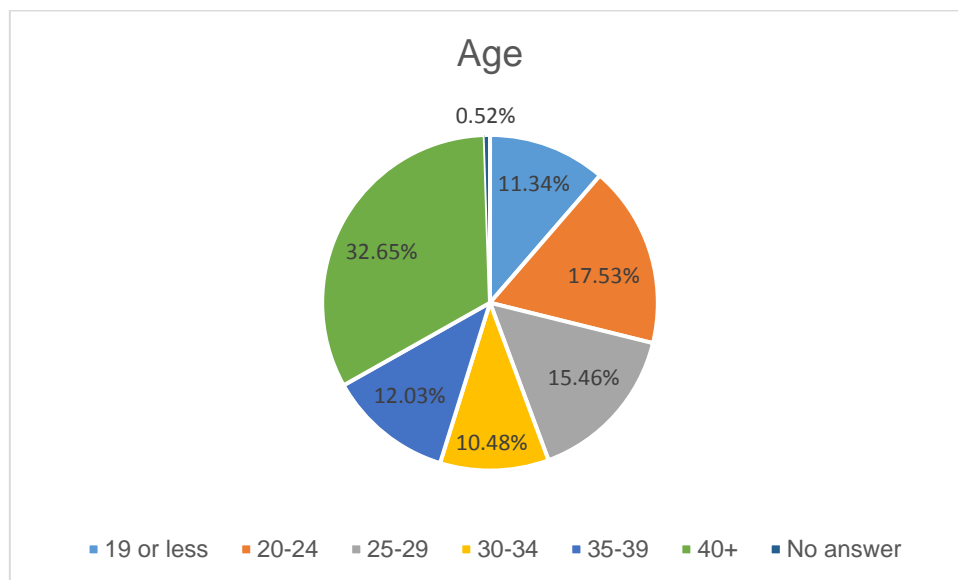


Figure 1: Age

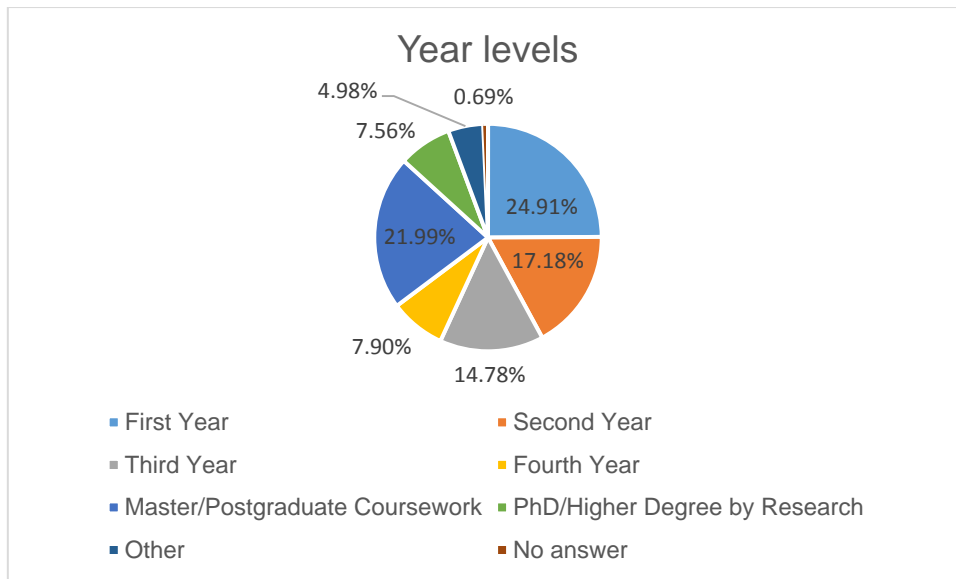


Figure 2: Year levels

Academic reading preferences

As shown in Figure 3, 413 (71%) of the students agreed or strongly disagreed that they remember information from their course readings best when they read them from printed pages. Students also consistently agreed that they could focus better on the material when they read it in print.

As shown in Figure 4, 459 (79%) of students felt they could focus better on materials when they are in print. As one student commented, "Printed pages supports my memory as I can also remember where on a page I read it. I can't do that with electronic reading". Another student noted that, "I am able to absorb information a lot better from physical printed information, particularly when I can highlight and take notes. Can't concentrate as well reading eBook format". Students commented that reading from screens was often tiring and gave them headaches. Students do appreciate the availability of electronic readings; however, feel they retain the most information when reading in print. As one student commented, "Though I think having access to articles and book chapters electronically is brilliant (and makes assignment and class prep very easy) I do prefer to print them out in order to read, highlight, and make notes which then helps me to retain the relevant information".

Although the majority of students feel they remember information or can focus better in print, some students did have a preference for electronic reading, due to its accessibility. As one student notes, "I do like having the book but am leaning towards electronic because of the ability to access it from any device and not having to carry heavy books everywhere. I can print out pages that I need". As another student noted, there are pros and cons to both modes; "Pros & cons to each. I find it more difficult to concentrate & retain information when reading from electronic devices. The search features are exceedingly useful. Portability is convenient, allowing for readings on public transport or when there is unexpected free time". Students also noted that they preferred print, as they were able to take notes and highlight

information in order to better remember information. Some students also acknowledged that their age had an impact on their preference for reading in print, especially as they had grown up with, and were used to reading in, print.

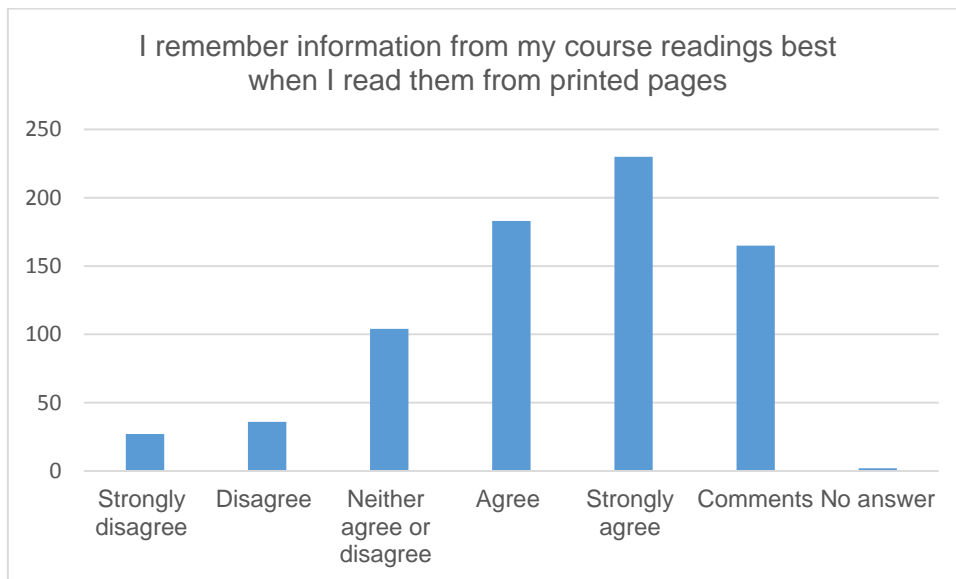


Figure 3: Remembering information when reading in print

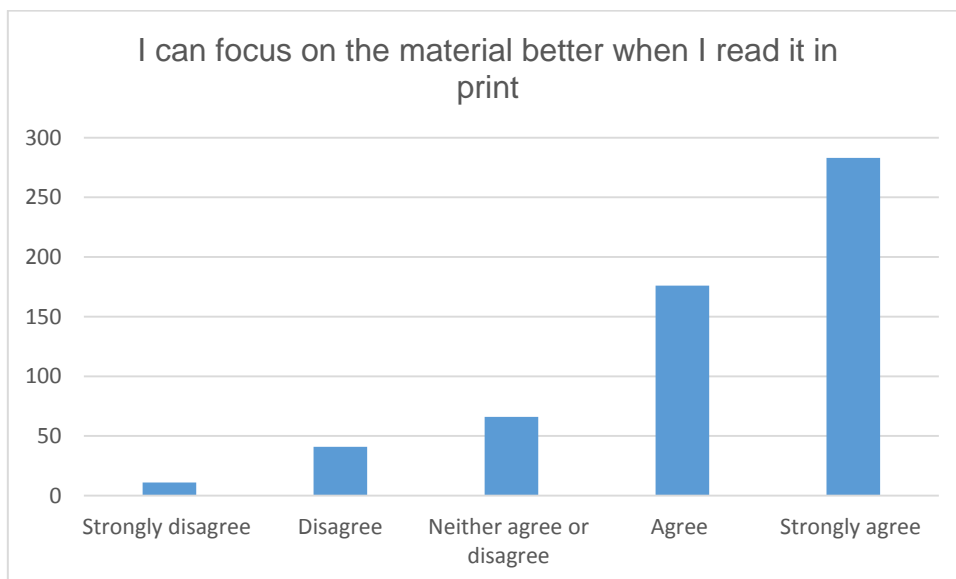


Figure 4: Focusing on material better in print

Students were asked if it is more convenient to read their assigned readings electronically rather than in print. As shown in Figure 5, students were fairly evenly split as to whether they found it more convenient to read assignment readings electronically or in print. 247 (42%) of the students disagreed or strongly disagreed that it was more convenient to read assigned readings electronically, with 220 (38%) agreeing or strongly agreeing that it is more convenient to read assigned reading electronically. Comments from those students who agreed it was more convenient to read electronically included comments on the convenience of reading anytime, anywhere with smart devices; “Much easier to read whenever wherever as most the

time you either have a tablet / laptop / smartphone with you”. Students also noted that electronic readings are more convenient for portability; “It is much easier in terms of portability to use my iPad (electronic device) than a book, especially if the book is bulky. I also find it difficult to 'word search' through hardcopy when compared to electronic copy”. Some students noted it depended on where you were reading your readings as to the mode they preferred to read in; “I enjoy the convenience of being able to access reading materials online when at uni, rather than carrying heavy textbooks. However, when given the option at home, I prefer to read from hard copy textbook”.

Some students also noted that cost has an impact on their reading preferences; “It is a lot cheaper to read everything online and not need to buy textbooks, but I prefer textbooks 100%”. The mode of study also impacted students’ preferences with this question. As one student noted, “I am an online student so I don't have access to the printed books in the library. Online reading is very important to me”. Students also preferred not just the convenience of reading electronically, but felt it was better for the environment; “Electronic is quicker and more mobile, and it is better for the environment”.

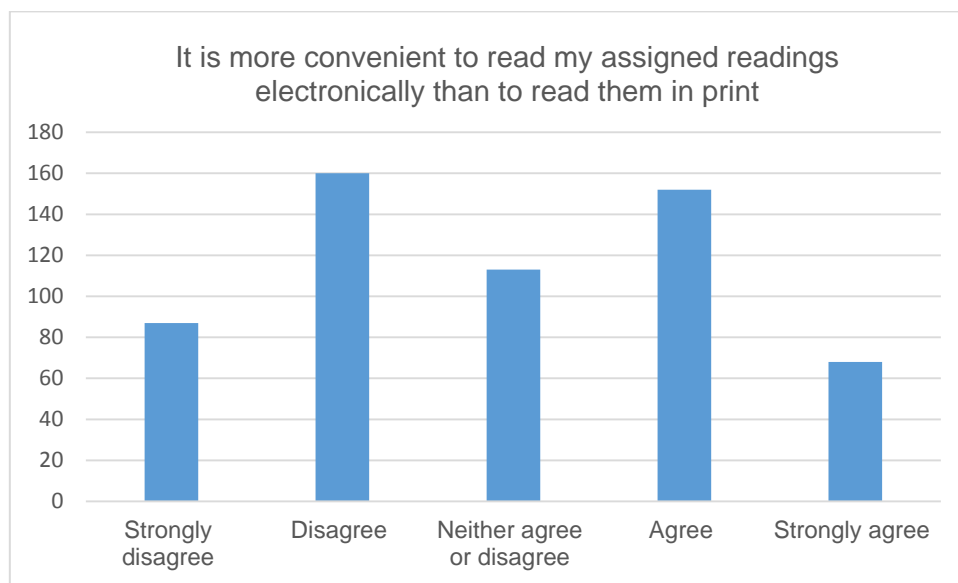


Figure 5: Preference to read assigned readings electronically

Students were asked if they usually highlight and notate their printed readings. As shown in Figure 6, 461 (79%) of students agreed or strongly agreed that they usually highlight and notate their course readings. Several students noted they like to print out materials, so they can highlight them and make notes; “I always feel the need to print out the digital copies so I can highlight and make notes”, “I like to print out readings so I can write notes, and highlight on the page”. As one student noted adding notes and highlighting was easier for them in print; “Reading from hard copies allows highlights and personal notes to be added more easily than in electronic format”. Some students also noted that they highlighted and made notes in electronic format as well.

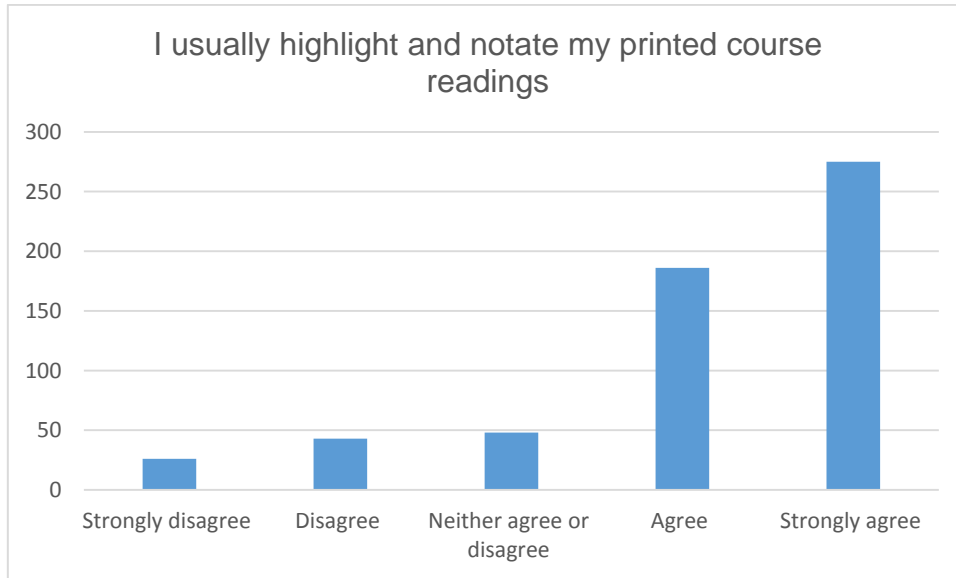


Figure 6: Highlighting and notating printed course readings

As shown in Figure 7, 352 (60%) of students agreed or strongly agreed that they prefer to print out their course materials rather than read them electronically. Often for students this was dependent on the length of the material as well as the cost. As one student notes, “Printing out depends on the length of the article, ECU does not offer students a free amount of printing per semester anymore, so I choose wisely on what I need to pay for to print”. One student also noted that it “depended on the length and difficulty of the reading; longer, more difficult academic readings are more convenient to have printed”. Another student stated that, “Ideally, I would print off electronic readings. However, printing is costly and I often won't print documents off if I don't feel the document is a definite must. Better in electronic version for over hundred pages”. Students also noted that they often don't print pages because it saves the environment.

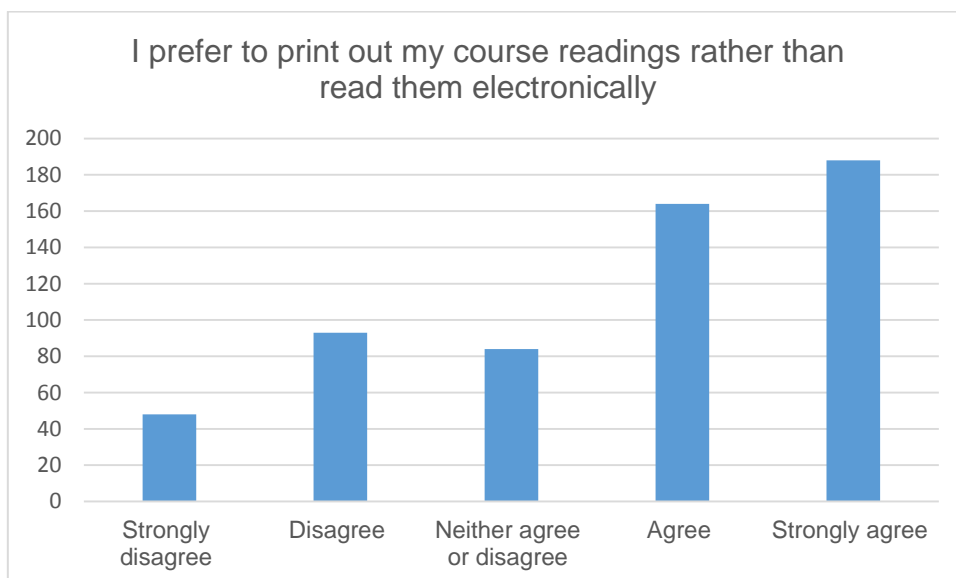


Figure 7: Printing out course readings

Students were asked if they were more likely to review course readings in print. As shown in Figure 8, 409 (70%) of students said they were more likely to review their course materials in print. This was for similar reasons as to why they prefer to read in print generally, as they can highlight, take notes, avoid eyestrain and focus better. Again this decision was also dependent on convenience of the format at the time they were reviewing their course readings as well as some students' preference to be able to search electronic documents.

As shown in Figure 9, 398 (68%) of students disagreed or strongly disagreed that they prefer electronic textbooks over print textbooks. The cost of textbooks had a great impact on the students' preferences of print versus electronic textbooks, as did the availability of textbooks in the library. One student noted; "I like electronic textbooks because they are cheaper, and have a word search function which makes finding the parts I need easier, but I do like to have a print book because it is easier to read due to the headaches I get from reading a screen too much". One student commented that it "depends on whether the textbooks are available to loan or whether they can only be purchased to buy myself, if they are in the library then yes I prefer a hardcopy to an eBook". Students also felt they would like more access to electronic textbooks in the library; "300 students in the course and only a few 'recommended reading' books available in the library"; "I only prefer to have readings available to me as a book because the current library access to online materials is extremely limiting. Online textbooks often don't load, regardless of internet access, and their 'loan' periods are currently a maximum of one day, far less than in print copies. If I could loan [sic] a digital textbook for the same time periods as I could a physical textbook, this would be far more desirable for me".

The weight of textbooks was also a consideration; "I can't carry with me more than one heavy textbook in my bag, trying to travel with any large textbooks is laborious. Digital textbooks, however, can be carried with me in great number all weighing as much as an iPad or Laptop. Meaning I can take them with me anywhere, at any time, and study at my leisure without having to break my bag or my back". Students also commented about their frustration as to the usability of electronic book platforms: "The electronic format provided by scholarly e-book libraries, such as EBook Central, is completely inadequate and very frustrating. Kindle isn't much better. Google Books is almost tolerable, at least for short books. "Electronic books are a pain to work with. They sometimes don't load properly or they can't be printed except a page range. I like to have hard copies as its [sic] easier to read and I don't forget about the documents". "I don't like electronic textbooks. I prefer print, easier to read, I like being able to easily flick between pages and not lose my original place. Sometimes scrolling through readings I lose where I am and find it harder to follow and skim in-between sections". On the other hand, some students did comment that they appreciated the usability of being able to find keywords in electronic books.

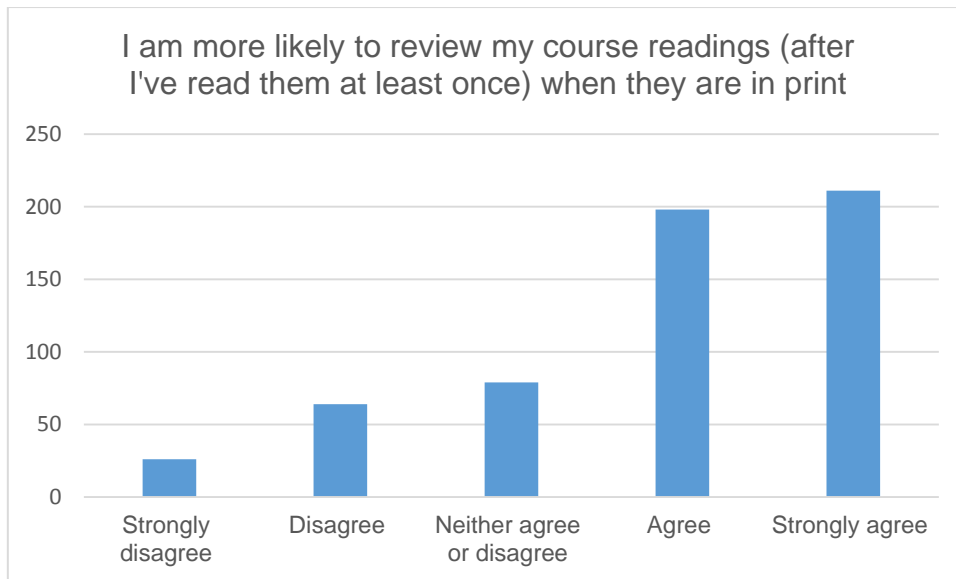


Figure 8: Reviewing course materials in print

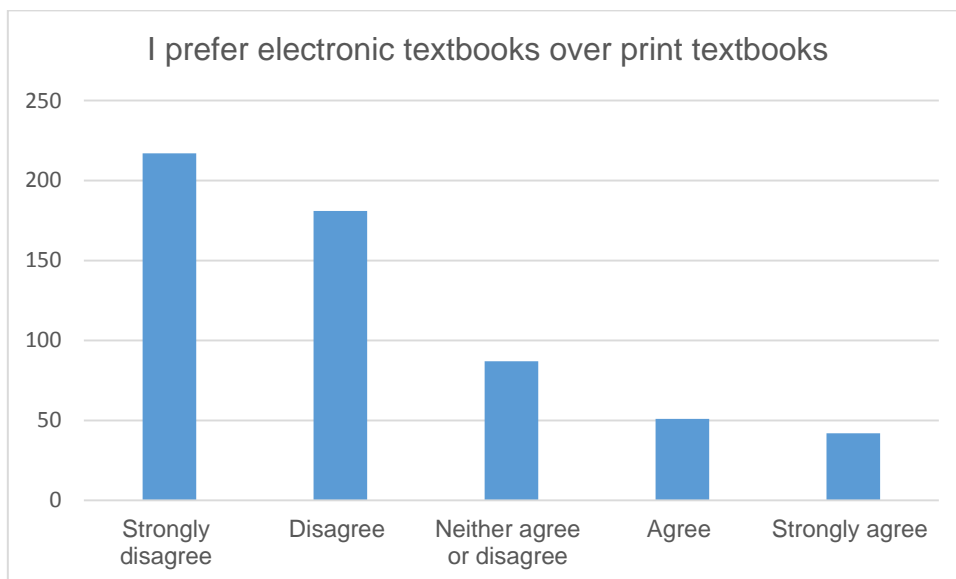


Figure 9: Prefer electronic books over print

Students were asked what tool they read their electronic course readings on. As shown in Figure 10, 437 (75%) read their material on a laptop computer, followed by a desktop computer, 237 (41%) and an iPad/tablet, 190 (33%).

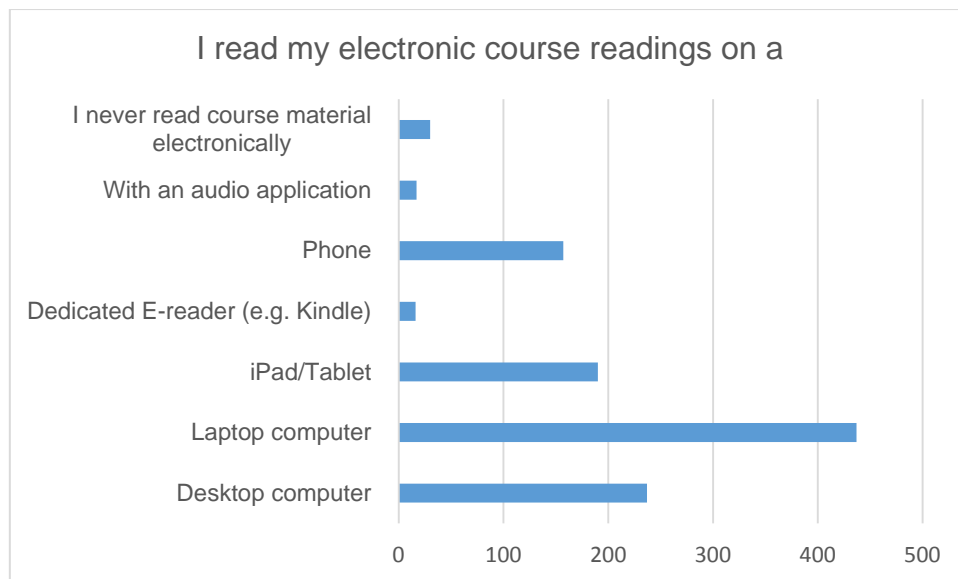


Figure 10: Reading tool

Statistical analysis

While the majority of all types of respondents prefer to read print materials and attribute better retention of information and focus on information to print format, some differences in response patterns are identified. Small effects attributed to gender were found, with females being slightly more likely than males to more strongly prefer print reading. The male and female respondent groups were analysed using the Mann-Whitney U test, and are statistically significantly different at $p < .01$, with an η^2 of .054 or .06 depending on the method used for combining Likert response items (summing or averaging, respectively). This means that between 5.4 and 6% of the variability in response can be attributed to gender, a very small effect size.

No effects attributed to major area of study or year level (freshmen, senior, postgraduate, etc.) were found. No statistically significant differences in the response patterns of students based on their major area, whether majoring in arts, science, or social science, are present in the data. Therefore, the academic major of the participants in this study has no impact on or correlation to the participants' preferences for print or electronic material.

Very small effects attributed to type of device used for reading, such as desktop computer, laptop, tablet, phone or e-reader was found. For instance, for those who read academic readings on an iPad or tablet, there was a slightly stronger observable preference for electronic reading compared to those who do not read on an iPad or tablet. The effect size is .0348, which means that 3.5% of the variability in responses can be attributed to the use or non-use of an iPad or tablet device. This is a very small effect. Those who do not use an iPad or tablet reported slightly stronger preferences for print reading, with an effect size of 0.0233, meaning 2.3% of the variability can be attributed to device usage. Again, this is a very slight difference. While this and other device correlations show statistically significant variances, the

effects are so slight that in practical terms they would require additional study or evidence to be considered meaningful.

Larger significant effects attributed to learning engagement behaviours were found. These mid-size effects correlate the act of annotating or highlighting electronic materials with a stronger preference for digital reading and a weaker preference for print reading, as shown in figures 11 and 12. Mid-size effects also correlate the act of annotating or highlighting print materials with a stronger preference for print reading and a weaker preference for digital reading, as shown in figures 13 and 14.

Responses in both cases were analysed for differences in distribution using the non-parametric Kruskal-Wallis H test. Groups are statistically significantly different with $p < .0005$.

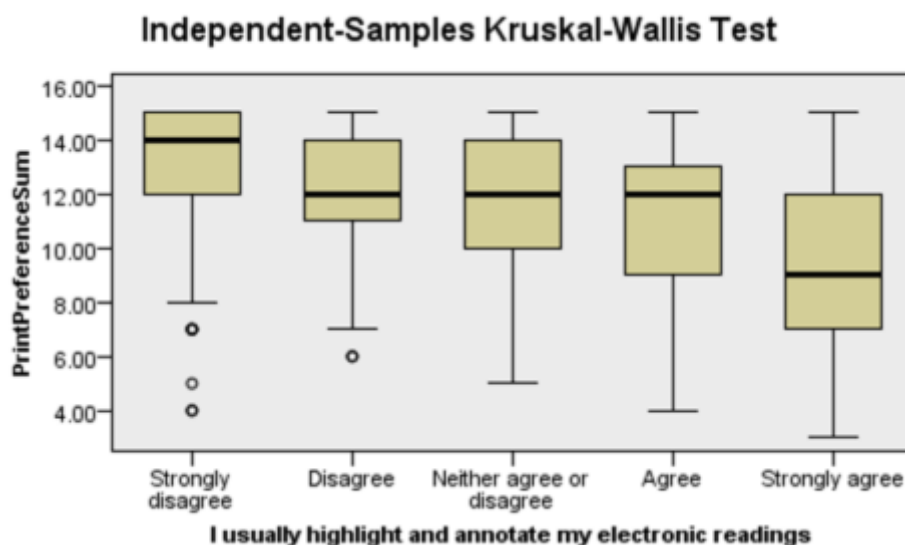


Figure 11: Boxplot distribution of responses showing that higher scores for print reading preference negatively correlate with self-reported highlighting and note-taking behaviour on electronic material. $n=578$; $p < .0005$; $\chi^2 = 63.763$, $df=4$.

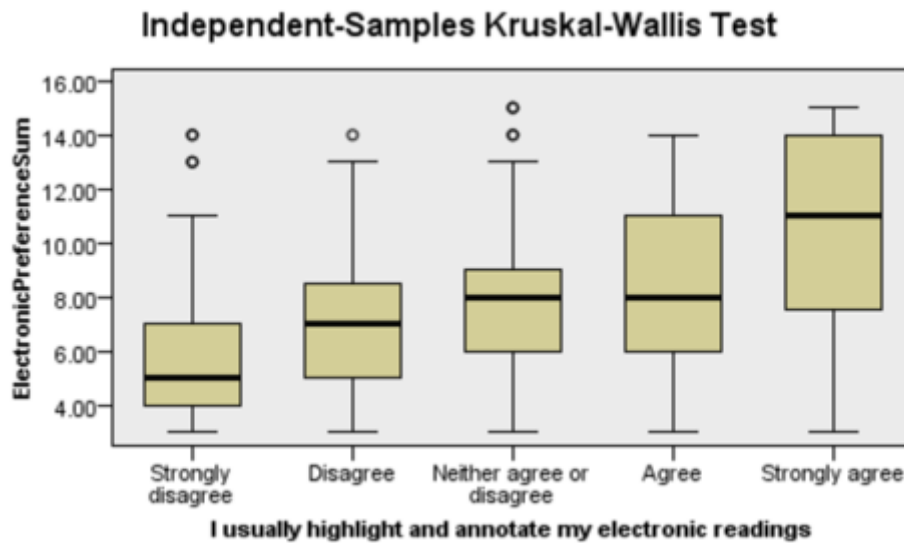


Figure 12: Boxplot distribution of responses showing that higher scores for electronic reading preference correlate with greater self-reported highlighting and note-taking behaviour on electronic material. $n=578$; $p<.0005$; $\chi^2 = 108.914$, $df=4$.

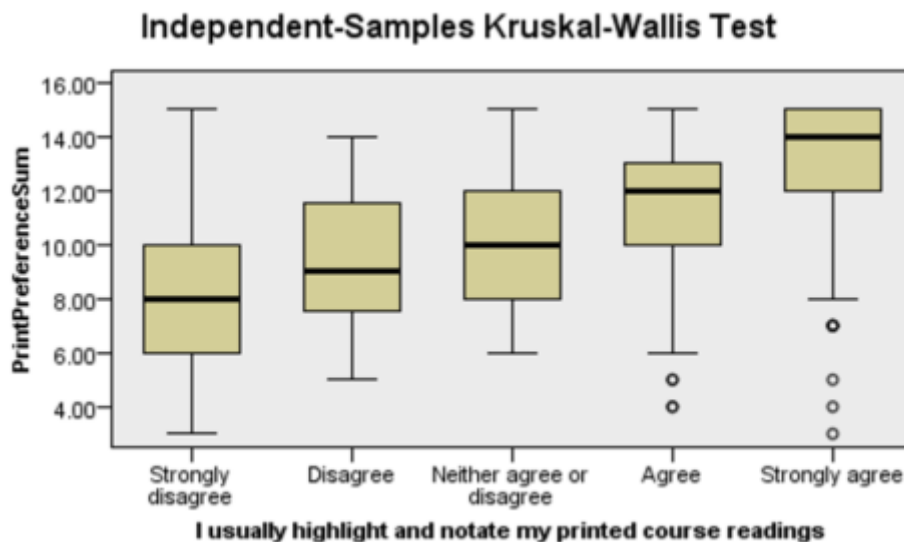


Figure 13: Boxplot distribution of responses showing that higher score for print reading preference correlates with self-reported highlighting and note-taking behaviour on printed material. $n=578$; $p<.0005$; $\chi^2 = 144.166$, $df=4$.

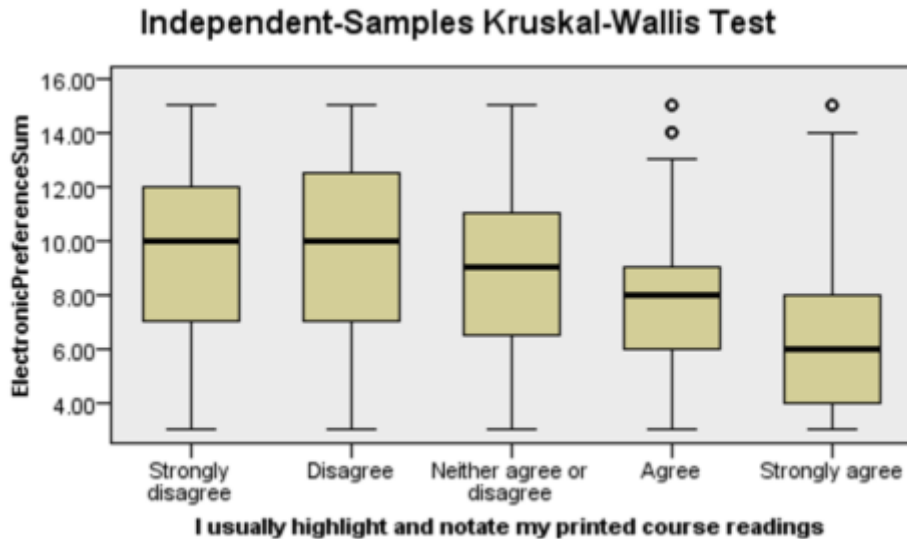


Figure 14: Boxplot distribution of responses showing that higher score for electronic reading preference negatively correlates with self-reported highlighting and note-taking behaviour on printed material. $n=578$; $p<.0005$; $\chi^2 = 90.754$, $df=4$.

Taken together, these findings demonstrate that the participants in this study are more likely to prefer reading in the same format with which they say they frequently use text engagement tools such as annotating and highlighting.

Discussion

Similar to other studies of academic reading preferences, this study also found that University students overwhelmingly preferred to read academic materials in print and stated that they focus better in print. Their reasons for this were similar to Mizrachi's (2015) study that print caused less eyestrain, that they like the tactile feel of print and that they were more inclined to highlight and make notes with print readings. This study is also consistent with other studies that have been done in the worldwide ARFIS study (Mizrachi et al., 2016), which found that reading preferences are impacted on by factors such as cost, convenience and accessibility. Comments from the students also indicated that the availability of textbooks in the library greatly impacted on students' reading behaviours and choices. Online students found it very important to be able to access electronic course readings and textbooks through the library, as they do not have the choice to come to campus. Cost also had an important part in play in their reading decisions. Several students noted their preference is to read in print, but their decision to read electronically is a financial decision and that, if the e-reading or e-textbooks were available in the library they would read this version. Several students noted that they would like more access to electronic textbooks as although they prefer print, there often were not enough copies in the library. It is important to note that ECU is moving to a model of purchasing institutional e-textbooks and this would seem based on this survey to solve issues related to cost and accessibility.

These competing concerns, of comfort, readability, usability and perceived learning and focus, versus the costs and convenience of e-formats, demonstrate that neither format is superior in all contexts. Clearly, there are task and material types for which

electronic texts are “good enough” or better than print, and this is typically associated with speed of access, portability and cost. Prior evidence suggests that these circumstances would generally be associated with less demanding learning situations and tasks, as well as shorter reading materials, whereas tasks which require deeper learning or more sustained focus as with lengthier texts, would lend themselves to print (Singer & Alexander, 2017b).

Several studies have shown that reading comprehension for complex tasks is often better in print and that some prior familiarity with digital reading devices may improve reading comprehension (Chen et al., 2014; Subrahmanyam et al., 2013). This study also showed that students frequently like to highlight and take notes in print format and that only a few students mentioned using similar features in digital formats. The analysis did find however that the participants in this study are more likely to prefer reading in the same format with which they frequently use text engagement tools such as annotating and highlighting. This correlation does not reveal any causality or directionality. It could be that participants who like and prefer electronic reading are more likely to take on use of the learning engagement tools provided within digital platforms; or it could be that participants who acquire skills with the use of those learning engagement tools find that their comfort, enjoyment and preference with electronic formats follows. It is possible that increasing preference and favourability towards digital reading could depend at least in part on improving a reader’s ability to engage with the electronic text in ways that include note-taking, annotating, and highlighting. This possibility seems logical in light of theories on cognitive load relating to comprehension. Acquiring fluidity with learning engagement tools found in electronic texts could be predicted to have some effect on reducing the additional cognitive load that might be encountered by readers when engaged with behaviours like digital scrolling (Singer & Alexander, 2017b) or switching between reading on a digital device and note-taking on paper, or trying to utilise unfamiliar digital tools like e-highlighters and notes features. If additional cognitive load is associated with e-formats and a reduction in comprehension, then various steps including user training on e-platforms may be indicated for reducing this load and increasing comprehension.

Conclusions

This research studies the self-reported preferences and behaviours of University students engaged in reading academic course material either in print or electronically. The overwhelming majority of participants prefer to read their course readings from printed pages, and say that they remember and focus better from printed materials. The findings in this study related to the focus, memory and behaviour of the participants are limited by the nature of self-reports, which are not always accurate. However, the finding that the majority of the participants believe they focus better and remember information better from print formats is consistent with the available empirical research on reading comprehension in print and electronic formats, suggesting that in at least some circumstances, learners may be accurately judging their own performance.

One indication for further research comes from the association between reported learning engagement behaviours and medium preferences. Determining the directionality and causality of this relationship, as well as whether format preferences

can be influenced by manipulating the amount of training and experience on digital learning engagement tools that participants are exposed to, will be important to explore further. Another area for future research is to explore if training in using the features of digital resources would improve usability satisfaction in e-resources and platforms.

University libraries can play a role in shifting students' preferences towards digital readings through providing training in how to more effectively use e-platforms. The study also gives libraries evidence they can use to lobby publishers to develop more user-friendly features and platforms. There are immediate implications for educational practice arising from these findings. Tertiary educators and libraries should carefully consider the role that print textbooks and collections, as well as printing services, may play in supporting student learning, and take steps to ensure that students are not disadvantaged by a scarcity of hard copy. Libraries could for example, focus more attention on retaining print collections (if budgets permit), have hybrid models for collection, develop mentor, lower printing costs in order to meet the reading preferences of their students.

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