Print and Digital Reading Preferences and Behaviors of University Students in Qatar

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Abstract. This paper presents findings of a study that investigated the reading preferences and behaviors of university students in Qatar. The study involved a survey of the print versus digital preferences of students in Qatar followed by an observation of the academic reading behaviors of university students using eye tracking glasses for explanatory insight. Results from the survey indicated that students prefer reading course materials and textbooks in print and felt they learn better this way. The eye tracking reading tests revealed some differences in print versus digital reading behaviors, for example that students tended to navigate differently in digital format by skimming and flipping back and forth more than in print, and that participants spent more time concentrating on the print text. These findings suggest that more can be done to improve the usability and readability of digital formats in order to help students read and learn more effectively.

Keywords: Reading preferences, reading behaviours, print, digital, format, electronic reading, eye tracking.

1 Introduction

This paper presents findings of a study that investigated the reading preferences and behaviors of university students in Qatar. The study was conducted in two stages with the first stage involving a survey of the print versus digital preferences of students at two universities in Qatar (including both undergraduate and postgraduate students in different disciplines). This survey is being undertaken as part of the larger Academic Reading Format International Study (ARFIS), which is investigating print versus digital reading preferences in 31 countries. The second stage of the project involved investigating the academic reading behaviors of different groups of university students in Qatar by using eye tracking software to investigate if their reading behaviors differ when reading print versus digital materials. The researchers were interested in investigating not only the students' reading preferences, but the differences in their behaviours when they read in print and in digital formats. The study aims to use the

data to provide recommendations on how to improve the usability of electronic course materials as well as provide insight into the reading preferences of students studying in Qatar. Eye tracking allowed the researchers to record and qualitatively analyse the reading behaviours of students. Eye tracking as a methodology is based on the "eye-mind hypothesis: the location of a person's gaze directly corresponds to the most immediate thought in a person's mind" [1, p.3].

This research study was conducted with undergraduate and postgraduate students in Qatar. Students studying in Qatar come from a diverse range of backgrounds and countries including Qatari nationals as well as a large number of expatriates from other Gulf countries, the Middle East, Asia, Africa, U.S.A, Europe and the U.K. Qatar University, the largest and national institution in the country, was instituted in 1973, and comprises eight colleges and over 60 specializations. As of spring 2015, the number of registrants had reached 17,606 male and female students, including 15,758 undergraduates. Courses are taught in both Arabic and English. A number of American and British universities also have small branch campuses on Education city, an initiative set up by Qatar Foundation. Each branch campus delivers courses and conducts research different specializations. Carnegie Mellon University in Qatar (CMU-Q) and University College London Qatar (UCL Qatar) are two of the branch campuses currently located within education city. CMU-Q was established in 2004 and specializes in business administration, information systems, biological sciences and computer science. In 2015, there were 414 enrollments of students from 37 nationalities. 60% of the students enrolled were female. UCL Qatar teaches four Masters programs in the cultural heritage area in library and information studies, museum studies, archeology and conservation studies. The first intake of students was in August 2012 and UCL Qatar has since enrolled more than 190 students from over 40 countries.

2   Literature Review

2.1   Reading Preferences of Students

Results of several surveys conducted as part of ARFIS have indicated that most students feel that print helps them to learn better and prefer reading their academic texts in print format. Students also as a majority preferred to print their class readings [2] [3] [4]. In a study conducted with 400 undergraduate students at the University of California, Mizrachi [5] found that overwhelmingly the students preferred print over electronic formats for learning purposes.The students reasons for preferring print included that print causes less eyestrain, the advantages of the tactile aspects of print and that they are 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 have an affect on their reading behaviors. Other studies has used qualitative methods such as writing in diaries to gauge the students' reading preferences. Foasberg [6] 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 nonacademic reading.

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 [7]. They also found that famililarity with electonic devices such as tablets results in more deep reading comprehension, leading them to conclude that you can improve electonic reading comprehension if you provided training to students on how to use electronic devices. Despite device familiarity having an impact on reading comprehension, students still prefer reading in print over electronically. 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 similarly to other studies that students were more likely to use special features in print books than in e-books [8].

2.2   Eye Tracking Studies

Eye tracking hardware and software has been utilised in numerous usability studies, testing the usability of web interfaces and well as studying users online search behavior. [9] [10] [11]. Eye tracking has also been used to study reading behaviour in areas such as font size [12], reading subtitles [13] and concept mapping [14]. Previous studies investigating reading behaviours of print text have focused on how variations in textual and graphic presentation affect behavior [1]. One eye tracking study that investigated how font size impacts online reading found that for smaller font sizes, fixation durations are significantly longer, resulting in slower reading and that there were no significant differences in serif versus san serif fonts.They did however, find that there were significant eye tracking differences for different age goups and whether English is the subject's first language. Early studies on font size have found that the ideal serif body text in the range of 9 to 12 points as less than 9 point font affects visibility and larger than 12 font slows down reading as people are forced to read in sections [1].

Eye tracking studies that focus on online reading tend to focus on usability factors such as issues of accessibility and navigation, the number of fixations on an object or area as well as the users' scan path. Lorigo et al.'s [9] eye tracking study on online searching of students reveals that on average 3.2 distinct abstracts were viewed following each query. Overall their findings revealed that if none of the top three results are relevant, then the user does not explore further results. In another study on scan path's where different web interfaces were tested, the researchers found that the users preferred scan path was impacted by the features of the Webpage and memory [15]. There are limited studies comparing the print and digital reading behaviours of university students. This study will address the gap through it's analysis of the

different behaviours of students such as their scan path's, fixations, navigation and use of features while reading academic materials in print and digital format.

3 Methods

The study was conducted in two stages with the first stage involving gathering data from a survey of the print versus digital preferences of students at two universities in Qatar. This survey is being undertaken as part of the larger Academic Reading Format International Study (ARFIS), which is investigating print versus digital reading preferences in 31 countries. Surveys were sent to a random sample of approximately 3000 undergraduate and postgraduate students at Qatar University and UCL Qatar in January and February 2016 after receiving ethics approval from both universities. The ARFIS questionnaire consists of 17 Likert-style statements on academic reading behaviors and preferences, six demographic questions, and an open prompt for any further information. Students had the option of completing the survey in either English or Arabic. Questions in the survey aimed to gauge the print and digital reading preferences including if factors such as length of texts and language impacted on their preferences. The full survey can be found in the appendices.

The second stage of the project involved an exploratory study investigating the academic reading behaviors of university students in Qatar by using eye tracking glasses and software to investigate if their reading behaviors differ when reading print versus digital materials. Eye tracking is useful because it can be used to measure behavior that would be difficult to obtain through other test measures and has previously been used as a method to investigate reading behaviors [1]. Students from Qatar University, Carnegie Mellon University in Qatar and UCL Qatar were recruited for the second stage of the study. The study used Tobii Pro glasses, which record eye tracking data. In order to complete the eye tracking test students were asked to complete two reading tasks. The first task involved reading one chapter in print with the second task involving reading one chapter of the same book on a tablet in the Kindle app. Both chapters were of the same approximate length and both contained figues or images. The book was a general undergraduate text on Psychology. For both tasks students were asked to write a 100-150 word summary of the chapter. The full task instructions can be found in the Appendices. The Tobii Pro Glasses recorded the eye movements of the participants. The data from the recordings was qualitatively analysed through watching the recordings and event logging the eye and hand movements of the participants. The scan paths, fixations, navigation and use of features while reading academic materials in print and digital format were recorded in the event log. Twenty students were tested in this exploratory test in May 2016 using the eye tracking glasses and software.

4   Results

4.1   Survey

A total of 105 surveys were fully completed by students. The majority of the respondents were female (85%) and undergraduate students (79%). Respondents were evenly dispersed across all of faculties at the university with respondents studying in the Arts and Social Sciences, Humanities, Business, Engineering, Science and Medical Sciences.

63% of the students who responded strongly agreed that they remember information from course readings bestter when it is in print form with a further 20% agreeing as shown in Figure 1 below. Students commented that often this was because print text allows you to highlight and take notes in order to retain information. One student stated "Mostly physical text helps the student highlight what's important and come up with questions to help him/her better understand and practice answering different questions", with another student commenting that "because it involved making handwriting note that somehow help me to remember the information". One student also commented on how reading print impacts on memory; "Other than it being my personal preference, several studies have shown the direct relation between reading print and memory strength". 74% of the students also disagreed that is was more convenient to read course readings electronically. Students felt this was because of a number of reasons and often depended on factors such as eye fatigue and the size of the computer screen device they are reading from, and that they get more easily distracted if they are reading on their computers.
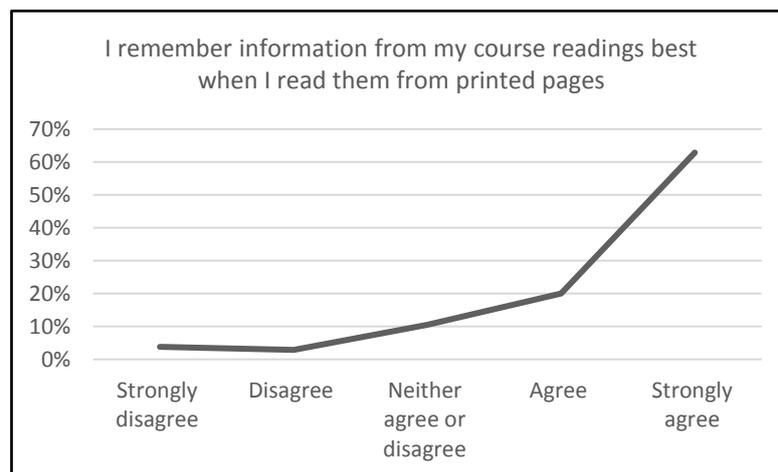
**Fig. 1.** Remembering information form print materials

Students also preferred to have all of their course materials in print with 76% of the students agreeing that this was their preference as shown in Figure 2. In regards to printing, students also have clear preferences about printing course materials based on page length. 78% of the students who responded agreed that they prefer to print their course readings if they are over seven pages. Some students noted that this was due to having eye strain if reading course materials electronically.
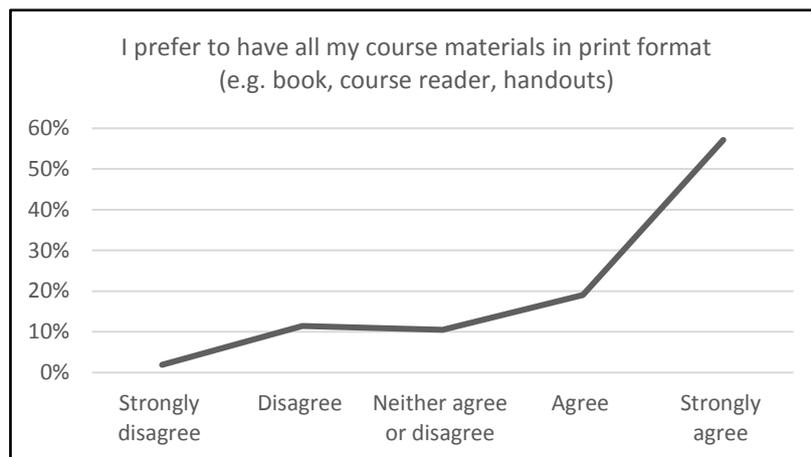
Fig. 2. Print format preference

Overwhelmingly, students also preferred to print out their course readings rather than read them electronically. Only 30% of students agreed that they would prefer to read materials electrnically if the material was under seven pages with some students stating that the number of pages did not matter. Some of the students who did not print out course materials stated that they did this for environmental reasons, with some students who do prefer to print out readings stating that their reasons were because of the poor quality of electronic or scanned material.

As figure 3 shows, a large percentage of students only highlight and take notes when reading in print. 92% of the students agreed that they take notes and highlight print course readings with only 25% of the students agreeing that they do this with electronic readings.
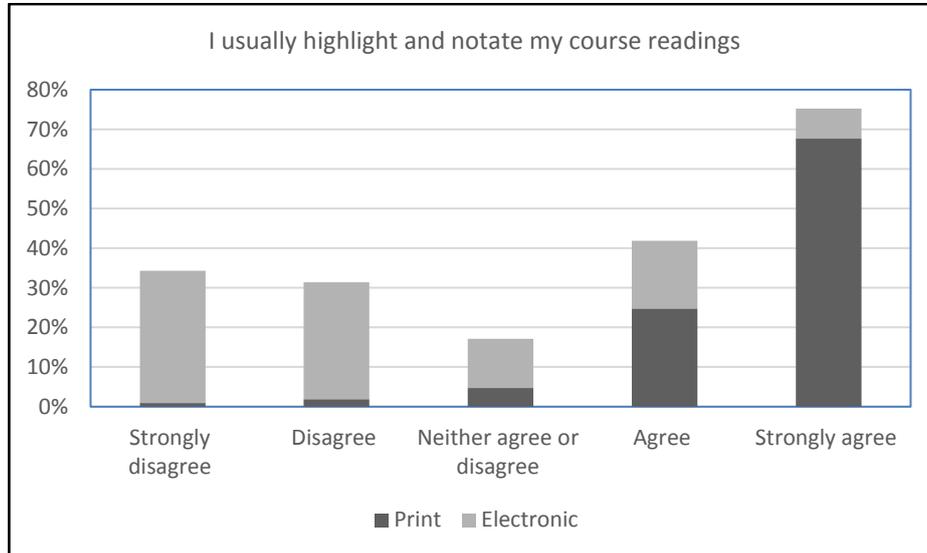
Fig. 3. Taking notes and highlighting

Another area the survey gathered data on was on whether language has an impact on the print or digital preferences of students. According to the results of this survey, language does not have a significant impact on the reading preferences of students at Qatar universities. 67% of the students disagreed that they preferred to read course readings which are in their native language electronically rather than print with students stating that they don't mind either way and they use both langauges when reading materials. 59% of the students agreed that they preferred reading foreign language material in print rather than electronic form, which again just indicates students preferences for print no matter what the language. Several students stated it didn't matter which language it was in as language was irrelevant to their preferences.

4.2   Eye Tracking

Twenty students completed the reading test using the eye tracking glasses. Twelve of the students were undergraduate students with eight postgraduate students completing the test. Of the students, sixteen were female, which causes some limitations to the data analysis as gender is not a factor that can be anlaysed for differences in behaviors. Nine of the studenmts spoke Arabic as their first language with the other students speaking a mix of English, Urdu, French, Somalian and Pashtu. Of the twenty students, fourteen stated they preferred to read all of their course materials in print format with sixteen students stating they remember information from course readings best when it's in print format.

The reading tests revealed both similarities and differences in how the students read in

print versus digital formats. Many students displayed similar reading behaviors in terms of their scan paths, but displayed different behaviors when it came to using the features of both print and digital formats.There were differences in the reading behaviors of students while reading print, but as this study is looking at the differences between print versus digital, that data is not analysed here. Most students scan path in both print and digital format was to scan the chapter line by line with no specifc fixations on different parts of the text. Students sometimes fixated on text before images or figures or the other way around in print or digital but with no significant differences between how they fixated on figures or images in print versus digital. On the whole however, students reading the digital format tended to skim more than in print and when navigating in digital tended to flip back and forth more. One reason for this was the students behavior when writing the summaries. When writing the summary of the text in digital format, students tended to start writing the summary at some point during the first reading of the text while referring back to the text often, as well as flipping back and forth alot and skimming. When reading print they tended to finish reading the whole text one full time, then write the summary referring back to highlighted points or handwritten notes.

Although students were given paper to write notes for both formats very few students wrote notes for the digital text with most taking some form of notes for the print. In terms of feautures, most of the students either hightlighted text, or underlined or circled words or sections with pen or pencil in the print text, with only one student using the highlighting feature in the digital format. This student plus one another were the only students to use any features in digital format which was to zoom in and out on the screen. Although there are some limitations in the study when it comes to reading speed as the students read different chapters, what the study did show was that students tended to take more time and concentration when reading the print, while tending to skim the words faster in digital format. Although comparing exact reading speed would have been of interest, it would have been difficult to test students reading the same text twice as they would naturally tend to read it faster on a second reading.

5   Discussion

Results of several surveys conducted as part of ARFIS have indicated that most students acknowledge that print works best for learning and still prefer reading their academic texts in print format [2] [5]. Results from the ARFIS survey in Qatar also support these results, with students from Qatar indicating that students prefer to print out their course readings rather than read them electronically and prefer reading course materials and textbooks in print.   Similar to Mizrachi's [5] study, students also stated their reasons for preferring print was because there is greater inclination to highlight and annotate printed readings and that reading print meant there would be less eyestrain and fatigue. Students who preferred digital did indicate that this choice was often due to wanting to be environmentally conscious. The eye tracking study also supported the findings of the survey with the test showing that students did

highlight and take notes in print format but not in digital format. This could indicate an unfamiliarity with the features of tablets and e-books. Chen [7] found when students are familiar with electronic devices there comprehension is better, so it could be argued that with training, students would start to feel familiar with the features and start to use them. Students reading behaviors indicates that they like to highlight and annotate, therefore lack of familiarity could be the only thing holding them back. One interesting observation of the study is that students mimic how they hold the tablet the same way they hold paper and also their scan path or reading path are similar in both formats. This finding along with the preferences of students to read in print format would indicate that when students do read in digital formats they are trying to replicate their print reading preferences and behaviors. This provides useful insights that can be used by publishers when they are creating e-books and digital course materials.

5   Conclusion

This study of the print and digital reading preferences of students in Qatar has found that overwhemingly students prefer to read in print format as well as feel they learn best when reading in print. The study also found that language does not have an impact on the reading preferences of students and that students preferences and behavior is to only use features such as highlighting and taking notes in print format. Students also indicated that they learn best with print and the eye tracking showed they spent more time concentrating on the print text, therefore there is still more that needs to be done to improve the usability and readability of digital formats in order to help students learn effectively while reading in digital formats. This study also shows that students mimic their print reading behaviors when reading in digital format and that they are more likely to skim in digital format than in print. Students are more easily able to concentrate and fixate on print text and using the features allows them to more easily summarise course materials. Although students may prefer print, the reality is that course materials are increasingly becoming available only in digital format, therefore, libraries and publishers can help students by providing both training in how to use features of digital formats and by developing user friendly digital formats that mimic print reading.

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