



Faculty of Cognitive Sciences and Human Development

**THE EFFECTS OF GENDER AND READING MEDIUMS ON
COMPREHENSION**

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**THE EFFECTS OF GENDER AND READING MEDIUMS ON
COMPREHENSION**

CORRIN ALICIA ANAK NERO

This project is submitted
in partial fulfilment of the requirements for a
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ABSTRACT

The present study examined the effects of gender and different types of reading mediums on comprehension among students. In the study, 40 undergraduate students that were grouped according to gender were asked to read four psychopathology texts, (two digital texts and two print texts) that were presented in counterbalanced order. To ensure that the experiment was equitable, pre-screening was done based on the participants' Malaysia University English Test (MUET) result as well as their knowledge in psychopathology. The results showed that there was no significant difference in terms of reading comprehension between gender. However, based on the mean scores, females scored slightly better in reading comprehension compared to males. The results also showed that there was no significant difference in reading comprehension between the two groups (print text vs. digital text), however, the mean scores in reading comprehension revealed that participants' performance in print reading was slightly higher than digital reading suggesting that participants may have benefitted from print reading a little bit more than digital reading. The present findings can elevate the understanding on the effects of digital and print reading as well as ensure that students are well aware of which reading mediums can promote better learning experience for them.

Keywords: digital reading, print reading, reading comprehension, gender differences, undergraduates

CHAPTER ONE

INTRODUCTION

The nature of learning has evolved in so many ways throughout the years especially when technology made its way into the learning process. Decades ago, learning was usually thought as reading physical books or printed texts but over the years, there has been progressing transition of reading from printed texts to screen due to the growing number of digital reading gadgets such as computer, laptop, tablet as well as smartphones (Liu, 2012). Liu (2012) also reported that many studies have proven that people tend to do better in reading printed text than digital text. However, another interesting view that can be taken into consideration from the emergence of technology in learning is the question as to whether or not there are any differences in gender concerning the performance in the use of technology in learning (Liu & Huang, 2008). Many would know that males tend to better in spatial tasks while females tend to outperform males in verbal tasks (Kimura, 2002). However, it would be interesting to know if the use of technology can produce similar outcomes or whether males outperform females in verbal tasks when technology is involved.

Reading is no doubt the essence of acquiring knowledge and gaining information and the process requires mental and cognitive efforts. Due to the fact that reading is considered an important activity in our life especially when it plays a huge role in learning, many studies have been carried out to address the issue in word reading and comprehension skills (Oakhill & Yuill, 1996; Seymour & Evans, 1994; Wagner, Torgesen & Rashotte, 1994). Recently, several researches have been studying the influence of printed and digital text on reading comprehension. Research in this field is normally conducted by having participants read printed text which is presented on paper and on-screen text which is presented via digital devices. After reading the texts, participants are tested on their comprehension by answering

questions regarding the text shown. The reading comprehension performance is determined by the scores obtained by the participants in the reading comprehension questions.

Based on a study conducted by Mangen, Walgermo and Brønnick (2013), on tenth-grade students, there are differences across mediums concerning speed of processing, text recall as well as reading comprehension. From that research, Mangen et al. (2013) concluded that students who read printed texts scored remarkably better in reading comprehension task as compared to students who read digital texts. Another experimental research that was conducted by Ackerman and Goldsmith (2011) on undergraduate students which aimed to study the encoding competence and the precision of metacognitive monitoring under the two study settings, on-screen learning and on-print learning in which they manipulated the study time. Results from the experiment showed that test performance did not differ between the two mediums under fixed study time while when study time was self-regulated, on-screen learning performance was worst as compared to learning through printed text. In addition to that, a recent study conducted by Singer and Alexander (2017), reported that participants recalled main points related to the main idea and other related information in the passage better when engaging in printed text rather than in digital text.

A survey conducted by Rideout, Foehr and Roberts (2010), concluded that individuals who read printed texts were less likely to multitask compared to when they read digital texts, hence proving why individuals tend to do better in reading print texts than digital ones. The reasons as to why individuals are less likely to do well in reading digital text can be due to the repeated engagement in digital multitasking that contributes to a more shallow processing of such text. (Levine, Waite, & Bowman, 2007).

In a research seminar reported by Wallis in 2010 (as cited by Singer & Alexander, 2017), the readers have the tendency to scan through on-screen texts than to engage with it deeply even when there are no actions of switching activities done by them. The differences

in perception that exists between digital and print text is due to the influence of several factors such as size of text, screen resolution, backlighting as well as luminance difference (Lee, Ko, Shen & Chao, 2011). Those issues were contributed by Liquid-Crystal Display (LCD) screens that are found in desktop, laptop, computers and handheld devices of which are the most common means of reading digitally. Mangen et al. (2013) reported that such screens might lead to visual fatigue which results from the lighting source. In addition to that, Garland and Noyes (2004) also further reported that additional features of an LCD screen, for instance the refresh rate, contrast levels and shifting lights contributes to the interference in the text recall process, hence providing further proof as to why people perform better when reading printed text than digital ones.

In another study conducted by Proaps and Bliss (2014) reported that other perceptual aspects involved in the processing differences between print and on-screen text is related to sequential versus continuous reading which means that the reader either has to scroll regularly between portions of each text or read in an uninterrupted manner. A study done by Wastlund (2007) further proves that frequent scrolling increases a reader's cognitive demands which in turn might result in negative effects in the recall task. Furthermore, print text permits readers to perceive and sense the spatial extension and physical elements of the text and the paper offers physical, tactile as well as spatiotemporally fixed prompts to the length of the text (Mangen, 2006).

Conversely, an article written by Prensky in 2013 reported that there were clear preferences for on-screen texts among individuals of varied ages (as cited by Singer and Alexander, 2017). A recent study conducted by Singer and Alexander (2017) had also found that students were reported to have a strong preference for digital texts and the students self-predicted that they had better comprehension skills in terms of reading digital texts. These preferences can be viewed as an indicator of the motivational advantages resulting from

reading digitally. People were reported to read twice as many digital books in average as compared to those who read only in print and the reason behind this is because the readers find that digital texts are a speedier option and are more portable than printed texts (Zickuhr, Rainie, Purcell, Madden & Brenner, 2012). Rideout et al. (2010) added that the duration taken by young individuals ranging from eight to 18 years old in reading printed texts has declined by about 5 minutes between 1999 and 2009, thus signifying a drift to more digital reading in the future. Besides the liking for digital texts, students perceive themselves as digital natives, armed with the essential skills in satisfying the demands of digital reading. Those self-efficacy verdicts would also appear to foresee students' engagement pertaining to learning from on-screen texts, and there is some proof to endorse students' self-judgements (Farah & Maybury, 2009). Farah and Maybury's study aims to examine the introduction of digital computer-generated microscopy technology into the syllabus of the School of Dentistry at the University of Queensland (UQ). From the study, it was found that through virtual microscopy and computer-assisted technology, student-centred learning of pathology seemed to improve the learning experience with regard to its efficiency in assisting students to be involved in and to interact with the course material.

Based on a study conducted by Kerr and Symons (2006), they found that participants in their research which consists of children in their fifth grade were able to navigate digital texts more competently as compared to printed texts. However, the results from the study showed that the participants read text slower on computers as compared to on paper, but they remembered more information that they had read from the computer than from paper. When time of testing was taken into consideration, that is, when time is fixed, the issue regarding the comprehension efficiency showed that the children were more competent at understanding the texts when reading from paper. (Kerr & Symons, 2006). Apart from that, another research conducted by McCrea-Andrews (2014) aimed to find the comparison of

adolescents' digital and print reading experience using either Nook, an e-reading device or book. The findings from the result showed that overall, students in the Nook group outperformed students in the book group after reading a moderately challenging text.

In terms of gender on the other hand, there have not been many studies that investigate the gender differences with regard to print and digital reading comprehension. In a study on the differences in comprehension between print and digital reading conducted by Sun, Shieh and Huang (2013) where gender was listed as one of the variables that they intended to investigate, it was concluded that males were better in screen reading whereas females outperformed males in print reading. Another study conducted by Wu (2013) investigated the gender differences in online reading activity, metacognitive strategies, navigation skills and reading literacy among students from 19 countries. The study found that there were gender differences concerning the knowledge of metacognitive approaches, navigation skills as well as in electronic reading assessment (ERA) and printed reading assessment (PRA), showing that females exhibited reading prominence in printed reading assessment compared to males. However, the gender difference in terms of electronic reading assessment was not significant among students in 12 out of 19 countries, suggesting that there may be minimal gender gap and little significant difference in terms of students' performance in electronic reading assessment (Wu, 2013). In addition to that, a survey to find out the preference towards the online reading environment between gender group conducted by Liu and Huang (2008) on university students in China revealed that female readers have clear preference for paper based-reading whereas males show a great sense of fulfilment with online reading as compared to females.

With all the varying findings reported in terms of some participants having better comprehension performance in print reading whilst some have clear-liking for digital reading, further exploration is needed to investigate the effects of reading mediums (digital text versus

printed text) especially given the fact that limited past studies have been conducted to examine the role of digital reading versus printed text, as well as gender factor in reading comprehension. On top of that, university students are considered digital natives; therefore they may be able to comprehend things better when reading through digital medium. Another reason why further exploration is needed is because limited studies conducted in the past use materials that participants are not familiar with. Most studies use reading assessments with passages on general knowledge. A study conducted by Singer and Alexander (2017) used materials that appealed to participants' interest although not directly related to their course and it was found that a few of the participants were highly knowledgeable in the topic chosen. This may create bias in the findings because a few of the participants have pre-existing knowledge with regard to the topic chosen. Pertaining to gender factor, it is an established fact that females outperform males in verbal task; notwithstanding that, however, further investigation is needed to find out if similar or different pattern of findings will emerge when digital text is used.

The above discussion raises the following research questions:

- i. Are there any differences in reading comprehension between female and male participants?
- ii. Are there any differences in reading comprehension between the two groups (printed text versus digital text)?

The goal of the present study was to find out if there are any gender differences in comprehension across different reading mediums and to investigate whether students, being digital natives, are able to comprehend better when reading through digital medium.

Since students these days show their preference for digital reading, this study aims to find out whether digital reading can actually benefit the students in their learning given the fact that they actually fit the context of being digital natives. The findings from the present

study would also help students to know whether gender differences exist in terms of reading comprehension regardless of the reading mediums used. In addition to that, the present study aimed to further explore the reading comprehension between males and females to raise understanding on how the gender factor can influence the performance in digital and print reading. Additionally, the findings obtained from the present study would be able to shed light on the effects of digital and print reading and to ensure that readers, particularly students, are well aware of which reading mediums can promote better learning experience for them.

The present study consisted of two independent variables; gender group and reading medium. The dependent variable on the other hand was the performance in reading task which was measured by the scores obtained (Figure 1).

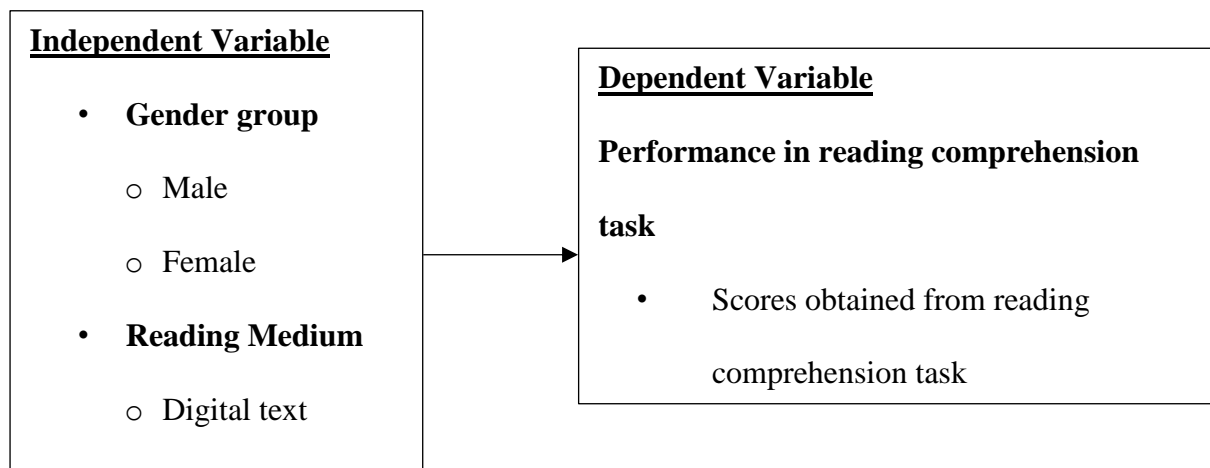


Figure 1. Conceptual framework for the present study

CHAPTER TWO

METHOD

2.1 Population and Sample

The target population for this study was the undergraduate students in Universiti Malaysia Sarawak (UNIMAS). Samples for this study was selected through simple random sampling to ensure an unbiased representation of the population. A total of 40 students were selected randomly with the equal number of participants representing both male and female genders. To ensure that the experiment was equitable, pre-screening was done based on the participants' Malaysia University English Test (MUET) result as well as their knowledge on the chosen topic for the texts used which was on psychopathology. In terms of MUET results, participants with MUET Band 3 and above were selected. MUET Band 3 was set to be the minimum requirement to ensure that the participants had at least a moderate level of English proficiency to reduce the chances of language proficiency affecting their performance. As for the topic knowledge, only participants who had no pre-existing knowledge on psychopathology and who had no explicit knowledge of psychopathology were selected.

Reason to pre-screen participants on their topic knowledge was based on the consideration related to the topic of text being read. A recent study by Singer and Alexander (2017), focused on students from the human development and educational psychology course and the text chosen for their study was on childhood ailments of which appealed to the participants' interest. However, such method was likely to introduce bias in which a few of the participants may have pre-existing knowledge on the text used, and therefore, their performance could be argued to be solely due to the experimental manipulation. Another reason why participants whose age ranged between 19 to 26 years were selected was because individuals of this age range would suit the description of digital natives (Prensky, 2001).

2.2 *Research Design*

The research design that used in this study was experimental research which involved mixed-subject design. This approach combined between-subject and within-subject design. The first independent variable which was gender group was varied between subjects where the participants were divided into two groups, male and female. The second independent variable which was reading mediums, was varied within subjects where each participant in both groups was exposed to all the conditions in the experiment, of which in this case involved having to read both printed and digital text. Within-subject design was chosen for the second independent variable because this design used the same participants for the different conditions hence, reducing the possibility of experimental error due to individual differences between participants. The materials used in the experiment was be presented in counterbalanced order. For example, one participant read printed article followed by on-screen article, printed article and lastly on-screen article while the next participant will start with on-screen article followed by printed article, on-screen article and lastly printed article. Printed text was presented on paper and the digital text was presented on computer screens because computer is one of the common devices for them to read digital documents.

2.3 *Instruments*

2.3.1 *Reading comprehension texts (Study Phase)*

Four reading comprehension texts about psychopathology were used for this study. There were two printed and two on-screen texts given for each participant to read comprising book excerpts which were of similar length. Printed texts were presented on paper while digital texts were read from computer screens. The digital texts were presented as Portable Document Format (PDF) files, which were read using Adobe Reader for Windows.

2.3.2 Reading comprehension questions (Test Phase)

The participants were given a total of 32 questions (28 multiple choice questions and 4 subjective questions) in the test phase. Each text passage had eight questions that carried 10 marks for them to answer, comprising seven multiple-choice questions and one subjective question. The subjective question was added to each set of questions to reduce the probability of the participants guessing the answers.

2.4 Data collection procedure

The experiment used a mixed-subject design where the participants were grouped according to gender and in each group, the participants were exposed to all the conditions. All participants were given a consent form for them to sign as an indication that they agreed to participate in this study. Participants were informed that they could opt out before, during, and after the experiment for any reason. After filling in the consent form, participants were given a short briefing to explain what they were supposed to do.

After the briefing, the students were given their first text passage for them to read, either in print or digital form (study phase). After they had completed the first reading task, they were required to answer eight questions in the same format as their reading (test phase). The participants were required to answer questions on the text they had read by recalling from memory. The steps for study phase and test phase measure were repeated three times according to the condition the participant was assigned to. For example, a participant read in the following order: printed text, digital text, printed text and digital text. The next participant read in the order of: digital text, printed text, digital text and lastly printed text. After completing the four study and test phases, the participants were debriefed and was allowed to leave.

2.5 *Data Analysis Procedure*

The data was analysed using Statistical Package for Social Sciences (SPSS) which used the two-way mixed ANOVA. The two-way mixed ANOVA is used when measuring two independent variables whereby one variable is manipulated using different participants and the other variable is measured using the same participants. In this case, 40 participants comprising 20 males and 20 females were exposed to all the conditions of the experiment which was reading both printed and digital texts. The independent variable in this study was the gender group and the reading comprehension medium while the dependent variable was the scores obtained from the reading comprehension task.

CHAPTER THREE

RESULTS

3.1 *Differences in reading comprehension between male and female participants.*

The two-way mixed ANOVA was conducted to find out differences in reading comprehension between female and male participants, differences in reading comprehension between the two groups (printed text vs. digital text) as well as the interaction between gender and reading medium. With regard to the first research question which was on the differences in reading comprehension between female and male participants, the results showed that there was no significant difference in reading comprehension between gender, $F(1, 38) = 0.381, p = .541$. This indicated that regardless of reading medium, the reading comprehension performance between females and males were no different from each other. Although the difference in reading comprehension between gender was not observed, it can be seen in Table 1 that the females mean scores in reading comprehension were slightly higher ($M = 13.13$) than males ($M = 12.78$).

Table 1

Means of reading comprehension performance between gender.

Gender	M
Female	13.13
Male	12.78

3.2 *Differences in reading comprehension between reading mediums*

With respect to the second research question, which questioned the differences in reading comprehension between the two reading mediums, it was revealed that it was not statistically significant, $F(1, 38) = 3.692, p = .062$, indicating that there was no significant difference in reading comprehension between the two groups (print text vs. digital text). This

suggested that the students' comprehension performance in digital reading was equivalent to their comprehension performance in print reading. Although the main effect of reading medium was not significant, the reading comprehension means in Table 2 showed that participants' performance in print reading ($M = 13.40$, $SD = 2.06$) was slightly higher than digital reading ($M = 12.50$, $SD = 2.63$). Therefore, this showed that students must have benefited more from the print reading compared to the digital reading.

Table 2

Means and standard deviations of reading comprehension scores for each reading mediums.

Reading Mediums	M	SD
Digital	12.50	2.63
Print	13.40	2.06

3.3 *Interaction between gender and reading mediums.*

With regard to the interaction effect between gender and reading mediums, the results showed that there was significant gender and reading mediums interaction, $F(1, 38) = 5.025$, $p = .031$. In terms of the mean values showed in Table 3, it could be seen that males scored slightly higher in digital reading comprehension ($M = 12.85$, $SD = 2.54$) compared to females ($M = 12.15$, $SD = 2.74$). As for the print reading, it was clear that females scored higher ($M = 14.10$, $SD = 2.02$) whereas males' mean score was 12.70 ($SD = 1.90$). This finding indicated that females fared better in print reading than males whereas males fared slightly better than females in terms of digital reading.

Table 3

Means and standard deviations of the interaction between gender and reading mediums.

Reading Mediums	Gender	M	SD
Digital	Female	12.15	2.74
	Male	12.85	2.54
	Total	12.50	2.63
Print	Female	14.10	2.02
	Male	12.70	1.90
	Total	13.40	2.06