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EFL Theory & Practice: Voice of EED UKI

English Education Department (EED) Collegiate Forum 2015-2018

Editor
Parlindungan Pardede

Pendidikan Bahasa Inggris
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"EFL Theory and Practice: Voice of EED UKI"

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PREFACE

English Education Department Collegiate Forum (EED CF) is an academic forum organized by the English Education Department, Faculty of Teacher Training and Education, Universitas Kristen Indonesia (EED FKIP UKI). Initiated in 2008 by Mr. Parlin Pardede Dean of FKIP UKI, the event was held bi-monthly in every even moth. It aims at providing a friendly and open opportunity for the faculty, students, alumni, and English teachers to share ideas, research findings, and experiences in English as a Foreign Language (EFL) field. It is expected that the forum can cater the interested parties an innovative and exciting opportunity to share, care, and collaborate for developing their professionalism in EFL learning and teaching.

Following related parties' recommendation, staring from 2015 the papers presented in the forum will be compiled and published in a proceeding in every four years. This proceeding, therefore, includes the 24 articles presented in the forum from 2015 to 2018. Since the presentation in this forum is voluntary, every resource person is free to decide the EFL topic he or she presents. Consequently, the articles in this volume cover a broad theme. Despite the broad theme, the topics covered in the articles do represent current hot issues in EFL, such as learning and teaching methodology and strategies; language skills, pronunciation, vocabulary, and grammar development; curriculum, evaluation and assessment matters; language research methodology, and the implementation of technology in EFL.

On behalf of EED FKIP UKI, I would like to offer my appreciation all faculties, students, alumni, and fellow English teachers who had contributed in EED CF along 2015-2018. My special thanks should go to Parlindungan Pardede whose hard work in editing the articles in this proceeding has made this publication possible.

Finally, I hope each article in this proceeding can inspire every reader as it had inspired the audiences when it was presented in EED CF.

Jakarta, July 26, 2019
English Education Department Chairperson,

Hendrikus Male

CONTENTS

Factors Attributed to Contradictory Research Findings in Print Reading vs. Digital Reading Effectiveness: A Literature Review[1]

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Abstract

As a result of the accelerating advancement of technology, the use of digital texts rapidly increases in all levels of education. This trend can be advantageous to EFL learners because digital texts provide them with rich comprehensible inputs they do not receive from their daily life environment. However, current studies showed contradictive results concerning the effect of print reading versus digital reading to reading comprehension. Some showed print reading superiority, some showed no significant difference, and some others showed digital reading superiority. This might cause teachers uncertain whether they should facilitate digital reading to their students or not. This article analyzes 20 recent studies showing the inconsistent results to see the possible factors attributed to the inconsistency. Two types of factors attributed to the contradictory results are identified. First, the varieties of the designs of the study, including the heterogeneity of the subjects' age-group and sample size inadequacy, varied settings, diverse independent and dependent variables, unclear measures validity and reliability, and inappropriate mastery or even absence of digital reading strategies among the participants. Second, the various advancement levels of the technology employed in the study.

Keywords: print reading, digital reading, reading comprehension

INTRODUCTION

One of the manifestations of technological ubiquity in the sector of education is the influx of digital tools into the teaching and learning process. Statista Research Department (2014) reported that though only 10.03 million e-books were sold in 2008 in the U.S., the sale increased to 457.09 million units by 2014. The study of VitalSource Technologies

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[1]This article was presented in The UKI English Education Department Bimonthly Collegiate Forum held on Friday, October 6, 2017

Inc. (2015) reported that the students who have used digital tools to read course material increased from 63% in 2011 to 87% in 2015, and those who read digital course materials frequently increased from 48% in 2011 to 78% in 2015. The use of digital tools as reading devices has also driven educational institutions to move to paperless classrooms around the world (Giebelhausen, 2015). Finland, a country well known for her best education system in the world) has emphasized the use of ICT in learning and teaching (National Board of Education, 2014). In addition to the features identified by some studies (Grajek, 2013; Lai, 2011; Usluel, 2016), that digital texts are interesting to use due to their portability, convenience, compatibility, media richness, and rapid and expanded access, using digital texts in EFL learning are advantageous. According to Internet World Stats (2017), 52.3% of the global web content is in English. By asking EFL learners to read these materials extensively, they will get rich comprehensible inputs which they do not receive from their daily life environment.

Despite the various potential advantages using digital texts in EFL learning and teaching in general and in English reading comprehension development in particular, the studies conducted investigate the effect of digital reading versus print reading to reading comprehension are not yet conclusive. Many studies (Ackerman & Lauterman, 2012; Liu, 2005; Mangen et al, 2013; Macedo-Rouet et al., 2003; Noyes & Garland, 2003; Solak, 2014; Wayne, 2003) showed that print reading was superior to digital text reading. Other studies (Grimshaw, et.al. 2007; Murray and Pérez, 2011; Nicoli, 2015; Wright et al, 2013) showed no significant accuracy difference between the two formats. Some other studies (Abanomey, 2013; Aydemir et al, 2013; Bhatti, 2013; Ebrahimi 2016; Fardy & Nabifar, 2011; Huang, 2014; Potocki et al, 2013; Saeidi & Yusefi, 2012; Taj et al, 2017), however, reported digital reading superiority to print reading.

On the one hand, the use of digital text is inescapable. On the other hand, a definitive conclusion that digital reading can facilitate students with better comprehension has not yet achieved. Such controversy could probably arise confusion among English teachers. Some teachers may ask, "If nobody is certain that digital reading can facilitate better comprehension than print reading, why should we bother engaging with the new reading mode? To diminish the confusion it is important to see why the results of studies concerning the effect of digital reading versus print reading to reading comprehension inconsistent. This article reviews and discusses the methodology section of 20 current studies investigating the effect of digital reading versus print reading to reading comprehension to see the possible factors causing the inconsistency. The reviewed studies were selected using criteria: (1) they reported recent experimental study (conducted after 2000); (2) they investigated the effect of digital reading versus print reading to reading comprehension in ESL/EFL learning and teaching contexts; (3) they were set in various parts of the world; and (4) they were published in peer-reviewed journals. This review is not intended to unravel the components of the reviewed studies but rather to see how the varieties of the methodological elements might have attributed to the conflicting results of the reviewed studies. The discussion in this review can hopefully provide English teachers with a better understanding of the dispute and enable them to facilitate today's students to develop reading comprehension.

DISCUSSION

Reading is undoubtedly very important in every individual's personal, mental, and intellectual and career development. It is also the main tool to boost a learner's mastery of other parts of language learning. Harmer (as cited in Pardede, 2008) accentuated that reading is beneficial to students' personal life since it may have a positive impact on their further studies and carriers; reading can facilitate joy; and reading is beneficial to their language acquisition since it improves their writing abilities, spelling, and vocabulary. Responding to the reading opportunity enlargement as the result of the surge of digital texts, online learning, and open resources of education, many studies have been conducted to explore the different effects of digital reading and printed reading to comprehension. However, before discussing these studies, a brief discussion on the nature of reading comprehension and the specific features of digital texts are presented as a basis of the discussion.

Reading Comprehension

The results of recent studies on reading emphasize that reading comprehension is an interactive process involving the reader, the texts, and tasks. This interactive view of reading combines bottom-up and top-down reading theories. While reading, the reader tries to construct an interpretation of the ideas the reader is communicating by considering units of language (sentence, paragraph, or passage) he is reading (bottom-up) and combines them with the knowledge he has already possessed (top-down). Thus, reading comprehension is the reader's attempt to construct the author's intent by using all resources available in the text and his previous knowledge. This is in line with Wolf's (1993) definition stating reading as "a constructive and active process that entails relating new and incoming information to information already stored in memory" (p.79).

The view of reading as an interactive process indicates that reading comprehension is a skill that goes beyond the decoding of the written symbols and the identification of the literal meaning of a written text. It refers to a reader's ability to understand and interpret written language through the interactional process of relating new and incoming information to information already stored in memory in a constructive and active manner (Bernhardt, 1991; Leslie, 1993; Tierney & Pearson, 1994). This is supported by McNeil (1992, p. 16) who stated that reading comprehension is "acquiring information from context and combining disparate elements into a new whole. It is the process of using one's exiting knowledge (schemata) to interpret text in order to construct meaning". Thus, in reading, it is the reader who constructs the meaning, not the text because meaning is not inherent in the text, it only has the potential for meaning (Widdowson, 1979). An obvious consequence of this is that the interpretations of any text differ from one reader to another. Urquhart and Weir (1998) posited that reading comprehension "will vary according to the reader's background knowledge, goals, and interaction with the writer" (p. 88).

Digital Text

Different from the printed text which has been used for ages, the digital text is relatively new. Digital texts are available for general use since over three decades ago. Digital

texts can be the one accessed from the internet in the form a web page, text message, or online postings such as blogs, or those kept in screen reading tools, computers or hand-handled devices. Digital texts are electronically generated and multimodal which blend texts with audio, video, image, and hypertext. These features make them more interactive than a printed text and invite the reader to explore in a nonlinear way. Hypertext, in particular, makes a digital text interconnected with many other texts which offer the readers various directional choices fitting to their interest. So, a single text can provide different access routes and, therefore, different options of reading. In this context, the hyper-textual nature promotes a flexible pattern of discovery which fosters readers' greater cognitive effort for they must construct information frameworks based on the nature of the paths chosen (Spires & Estes, 2002). Obviously, if teachers can develop truly interactive language-learning systems using hypertext to facilitate diverse learning needs and styles, it can be a valuable instructional tool for advancing learners' reading skills. However, since they lack the hierarchical and static structure, digital texts are more ambiguous than printed texts.

In addition, unlike the printed text which is static, digital texts are not in a constant state. The shape, size, location, and color of web text, for instance, can be altered. These features can be advantageous, because the reader can, for instance, adapt the font size to his need. On the other hand, increasing the font's size will limit the amount of text visible to the reader. This will make it more difficult to relate the information presented in one section to those in other sections. Thus, the reader's ability to follow the logical connection between ideas will be reduced.

By comparing the features of printed and digital texts and the reading strategies necessitated to accommodate these text features, four major differences between print reading and online reading are identified. First, Chen (2009) found that while print texts are usually linear, online texts are often non-linear or multi-linear. Second, different from the print texts usually characterizing with a prefixed and predictable path, digital texts' path takes a random and unpredictable manner. Third, readers can see less text at one time in the digital text due to the space limitation of the computer screen through which the reader looks at the text. As a consequence, compared to conventional print texts readers, online readers face more challenges in their struggle to comprehend what they read (Coiro, 2003). Fourth, the availability of hyperlinks in digital texts makes them more complex for readers to navigate, both in their mind and physically on the screen (Coiro & Dobler, 2007).

Studies on the Effect of Digital Reading to Comprehension

Various studies comparing the effect of reading digital texts versus printed texts to reading speed, accuracy and comprehension have been carried out since the 1980s. As stated previously, these studies showed inconsistent results. The majority of early studies showed that print reading was superior to digital reading in terms of speed, accuracy, and comprehension, while the rest studies reported insignificant differences. Some of the more recent studies still showed print reading superiority over digital reading, but many others showed that students comprehend digital texts more effectively

than printed texts, while some others showed no significant difference between the two modes of reading.

Noyes and Garland (2003) examined directly comparable texts in the two media in terms of correct answers and memory retrieval measure among 50 postgraduate students. While the obtained score indicated improvement between the pre-tests and the post-tests (designed in multiple-choice questions), the results showed no significant difference in terms of comprehension scores obtained through reading from the screen and paper texts. In the same vein, Wayne (2003) divided the 267 college freshmen into three groups and exposed them to three different forms of text presentation to determine if a significant difference existed in the short-term knowledge retention of the participants reading informational stimulus materials presented through one of three different text display modes. After reading the material for a period of time, they were evaluated on its content via a multiple-choice test. The results showed that the comprehension of groups who read from the printed text was significantly higher than the groups who read the texts from the computer screen.

The study of Macedo-Rouet et al. (2003) involving 47 undergraduate university students in Brazil examined print and online presentations of a multiple document report effects to the participants' comprehension, perception of cognitive load, satisfaction, and attention. The effect on reading comprehension was tested using multiple-choice questions. The findings showed that e-book readers obtained slightly lower comprehension scores than printed book readers. Interestingly, it was also found that that the comprehension decrease was limited to questions concerning complementary documents, or documents that were not immediately visible on the computer screen but had to be selected through a menu. The researchers reported that e-book readers needed time to perform mouse clicks to go from one page to another and needed to use the scroll bar while reading (Macedo-Rouet et al., 2003).

Liu (2005) investigated reading behavior in the digital environment by asking 20 participants to recollect their overall university students reading habits over the 10 years through a questionnaire containing 17 questions. The findings revealed that when reading on screen, people tend to engage more in browsing and scanning, one-time reading, and non-linear reading, with less sustained attention and less time spent reading in-depth. Such findings suggest that digital reading comprehension is inferior to printed text reading.

Mangen et.al. (2013) explored the effects of reading PDF texts on a computer screen versus printed texts. The participants, 72 tenth graders in Norway, were randomized into two groups. One group read two PDF texts (1400-200 words each) on a computer screen. The other group read the same texts in print. To measure their reading comprehension, tests in multiple-choice questions were assigned. The findings revealed the students reading in print scored significantly better on reading comprehension than those read digitally.

Solak's (2014) study investigated the preference of 96 prospective English teachers in a university in Turkey in performing computer and paper-based reading tasks and to what extent computer and paper-based reading influence their reading speed, accuracy, and comprehension. The collected data were classified into two types. First,

the participants' views on their computer and paper-based reading activities gathered using a questionnaire for online reading comprehension. Second, data concerning the participants' reading speed, accuracy, and comprehension in both digital and print reading activity which was collected through an experiment with 14 volunteerS. The results suggested that the participants preferred paper-based reading to the digital version and their performance was higher in print reading than digital. It was also shown that reading speed on a computer screen was nearly 12% faster than paper-based reading.

Ackerman and Lauterman (2012) conducted a study to examine the effects of time pressure on learning texts on-screen versus paper among undergraduates reporting their preference on reading printed texts. Participant's comprehension was measured using multiple-choice questions. In the first experiment, test scores on paper were higher than on-screen under time pressure, but no difference under free regulation. In the second experiment, to include time pressure, free regulation, and an interrupted condition, the time condition was manipulated within participants by unexpectedly stopping learning after the time allotted under time pressure. Although technology-related barriers should have taken their effect also in the interrupted study condition, No media effects were found in this condition. The participants who preferred paper-based learning and engaged in this learning medium improved their scores when the time constraints were known in advance. Such adaptation was not found on screen regardless of the medium preference. Beyond that, paper learning was found more efficient and knowledge self-assessments were better calibrated under most conditions. The results strengthened printed texts reading superiority on comprehension.

The study of Nicoli (2015) explored students' the differences in the effect of digital and paper reading modes to reading comprehension. Using the quasi-experiment design, the study involved 231 students enrolled in military leadership courses who were randomly assigned to read either digital (n = 119) or paper (n = 112) versions of a leadership article. Completed reading the text, the participants' comprehension was measured using 10 multiple choice questions and 2 sentence completion items. The results show no significant differences in group means of recall between the two reading versions.

Murray and Pérez's (2011) study compared 32 undergraduate students' reading comprehension performance in two sections of an online course. A group of the students used an e-textbook and the other used a paper-based text. The students' reading performance was measured through the results of two objective-based exams whose questions were mapped directly to the content covered in the texts. The results indicated there was no significant difference in student performance.

However, the study of Abanomey (2013) exploring the effect of the internet-based versus print reading on reading comprehension performance of EFL students at Riyadh College of Technology, Saudi showed digital reading superiority. In this study, the experimental group took a reading comprehension test in an internet format, while the control group got it in print format. The test, designed in multiple-choice form, was aimed to assess both higher-level and lower-level processes involved in reading

comprehension. The results showed that the experimental group had better reading comprehension than the control group.

The study of Aydemir et.al. (2013) investigated the effect of reading from a digital text with various levels of in the informative and narrative text reading comprehension among 60 fifth graders. The control group (N=30) was assigned to read printed materials, while the experimental group (N=30) read the digital version of the same material. To measure the participants' reading comprehension, an objective test based on the contents of the six passages was developed. The results showed that the levels of the informative texts reading comprehension of the experimental group were significantly higher than those of the control group assigned to read the printed texts. However, the narrative text type caused no significant effect on the averages in both groups.

Grimshaw et.al. (2007) compared children's comprehension and enjoyment of storybooks in digital versus printed medium of presentation. Involving 132 children of 9-10 years old, two different storybooks were used in the study. Among the participants, 51 read an extract from The Magicians of Caprona, about half-reading an electronic version with an online dictionary, and the rests read a printed version with a separate printed dictionary. The other 81participants read an extract from The Little Prince, 26 read an electronic version, 26 others read the same text with narration, and the rest 29 read a printed version. No dictionary was provided in this storybook. The results of the comprehension test designed in multiple-choice and filling blanks question showed that the children generally took longer to read an electronic version than a printed version of the extracts. However, there was no significant difference in the children's comprehension scores when they read the printed version, compared to when they read the electronic version.

Ebrahimi's (2016) involving 60 Malaysian ESL college students (30 students in the experimental group and 30 students in the control group) plus 60 Iranian EFL college students (30 students in the experimental group and 30 in the control group) was aimed to examine the effect of digital reading on reading comprehension of English short prose texts among the participants. The control group was asked to read 10 short literary prose texts using print reading, and the experimental read the same texts employing both print and digital readings. To test their comprehension, both groups were asked to answer open-ended comprehension questions from the literary works they had read by providing very short answers. The findings revealed both ESL and EFL experimental groups had a significantly better reading comprehension than the ESL and EFL control groups. Therefore, it was concluded that integrating digital reading program to literature programs helps students to improve reading comprehension.

Saeidi and Yusefi's (2012) study involving 40 Iranian female intermediate EFL learners (18 to 25 years old), examined the effect of computer-assisted language learning (CALL) on reading comprehension in Iranian English as a foreign language (EFL) context. The participants were randomly selected and were assigned into two groups of experimental and control. The control group was taught reading using printed texts. The experimental group was taught reading the same materials using three types of software. A posttest designed by following the Cambridge ESOL Preliminary English

Test was employed to compare the students' reading comprehension. The results showed the experimental group performed significantly better than the control group.

Fardy and Nabifar's (2011) true-experimental study involving 60 Iranian female intermediate EFL learners showed a different result. In 12 learning sessions, the control group was assigned to read printed pages in a conventional classroom, while the experimental group read the same texts from the computer screen. The same instructor taught both groups. The reading comprehension post-test consisting of 50 multiple choice items results revealed that the experimental group significantly outperformed the control group.

Huang's (2014) study examined the effectiveness of online versus paper-based reading strategy instruction on university 57 Taiwanese university EFL learners' reading comprehension. The control group was taught reading using paper-based materials while the experimental group was taught using computer-based texts. Both groups received four-hour training and reading period. Their comprehension was measured by asking each student to write a recall in either L1 or English. The results demonstrated that the online reading group outperformed the paper-based group on overall reading comprehension.

Another study by Potocki, Ecalle, and Magnan (2013) conducted a one-year study to examine the effect of using computer-assisted comprehension training on 258 second-graders in France experiencing comprehension difficulties at the beginning of learning to read in the east of France. The students were randomly divided into the control and experimental groups. The experimental group was trained using a software program devised to develop comprehension skills, while the control group was trained using grapho-syllabic training intended to foster decoding skills. Their comprehension level was measured using 12 multiple-choice questions. The results revealed that the experimental group exhibited a greater level of progress in both listening and reading comprehension. This effect was perceived lasting for after 11 months the results remained the same.

The study of Bhatti (2013) involving 60 ninth-grade male students in Pakistan. The students were grouped into the experimental group (N=30) was taught 24 reading skills lessons through CALL, while the control group (N= 30) was taught the same lessons by a traditional instructor-led class. All participants had no prior experience with computers. Multiple-choice questions were employed to measure the participants' reading comprehension. The results showed that CALL was 35% more effective than the traditional instructor-led class.

Wright et.al. (2013) carried out an AB experimental design to compare vocabulary understanding and reading comprehension scores from two reading sources (electronic storybook and paper-based book). The use of reading resources available (dictionary, thesaurus, word pronunciation) between the two reading methods was also evaluated. Involving three female second graders, each participant was engaged in four reading sessions which lasted in one and a half to two hours per session. During the reading sessions, the participants read one story using a traditional paper-based book and one story using an electronic-based book. Every story reading is ended with a quiz including some multiple-choice questions. The results show that despite the vocabulary and

reading comprehension consistency between the two reading methods, students tend to employ reading resources while engaging with digital text.

The study of Taj et.al. (2017) involving 122 first-year university students in Saudi Arabia investigated the impact of the affordance of CALL and mobile assisted language learning (MALL) on the participants' EFL reading comprehension. This quasi-experimental study used a pre-test and post-test control group design. In six weeks, the experimental group was assigned computer-based reading comprehension exercises in the language laboratory twice a week, while the control group received the same exercises using printed texts. In addition to these exercises, glossed vocabulary cards were also presented to the experimental group by sending them to the participants' their mobile phones through WhatsApp application. To measure both groups' comprehension, an achievement test consisting of 20 multiple choice questions was developed. The results showed the computer-based reading superiority.

Tabel 1. **Comparison of the Reviewed Studies**

No	Studies	Mode with better Comprehension	Participants	Sample/ Participants	Test Form
1	Abanomey (2013)	Digital	HE students	348 students	Multiple choice
2	Ackerman & Lauterman (2012)	Print	HE students	156 participants	Multiple choice
3	Aydemir et.al. (2013)	Digital	5th Graders	60 students	Multiple choice
4	Bhatti, 2013	Digital	9th Graders	60 students	Multiple choice
5	Ebrahimi (2016)	Digital	HE students	120 students	Open-ended
6	Fardy & Nabifar's (2011)	Digital	HE students	60 students	Multiple choice
7	Grimshaw et.al. (2007)	No Difference	3rd Graders	132 students	Multiple choice & fill in blanks
8	Huang (2014)	Digital	HE students	57 students	Recall essay
9	Liu (2005)	Print	HE students	20 students	Recall questions
10	Mangen et.al. (2013)	Print	10th Graders	72 students	Multiple choice
11	Macedo-Rouet et al. (2003)	Print	HE students	47 students	Multiple choice
12	Murray and Pérez (2011)	No Difference	HE students	32 students	Multiple choice
13	Nicoli (2015)	No Difference	HE students	231 students	Multiple choice
14	Noyes & Garland (2003)	Print	HE students	50 students	Multiple choice
15	Potocki et.al. (2013)	Digital	2nd Graders	258 students	Multiple choice
16	Saeidi & Yusefi (2012)	Digital	HE students	40 students	Multiple choice
17	Solak (2014)	Print	HE students	96 students	open-ended
18	Taj et.al. (2017)	Digital	HE students	122 students	Multiple Choice
19	Wayne (2003)	Print	HE students	267 students	Multiple choice
20	Wright et.al. (2013)	No Difference	2nd Graders	3 students	Multiple choice

As shown by the recapitulation presented in Table 1, the 20 reviewed studies show inconsistent results of the effect of reading digital texts versus printed texts on reading comprehension. More than one-third (35%) revealed that printed text reading outperforms digital text reading; 20% revealed no significant difference; and the rest 45% showed digital reading superiority. Such contradictory results can be attributed to several factors.

The first factor concerns with the varieties of the designs of the studies. The first element of the design varieties is related to the heterogeneity of the age groups of the subjects. As shown in Table 1, the majority (70%) of the reviewed studies involved university students, while the rest 30% involved K-12 students, ranging from the 2nd to the 10tg graders. Even the university students participated in the 70% of the studies were quite heterogeneous. Many studies involved students of the same majors, while others include students from some departments, and some of the studies involved students of the same batch, while the others involved students from different years. Some other studies (Aydemir et al, 2013; Bhatti, 2013; Mangen et al, 2013; and Potocki, Ecalle) involved K-12 school children.

The second element of the study designs varieties is related to the sample size of the participants. Some of the studies (35%) involved less than 60 participants; 25% involved 60 to 100 participants and the other 40% involved more than 100 participants. Due to their limited sample sizes, some of the results must be read cautiously, because small sample size lessens the confidence level of a study.

The third element concerning the study designs varieties is the experimental settings. Some of the reviewed studies were carried out in classrooms or computer laboratories. Some others let the participants read at schools and at home as well. Such variety makes it difficult to generalize these results beyond the conditions of these reviewed studies.

The fourth element concerns with the dependent and independent variables of the studies. For examples, Noyes and Garland (2003) used reading from the screen and paper texts as the independent variables and memory retrieval as measured by a test in multiple-choice questions as the independent variable; Wayne (2003) used three different text display modes as the independent variables and short-term knowledge retention as the independent variable; Mangen et.al. (2013) took reading PDF texts on a computer screen and reading printed texts as the independent variables and short-term knowledge retention as the independent variable; and Nicoli (2015)'s study used a single reading session on digital versus paper reading as the independent variables and short-term knowledge retention as the independent variable. Similar to the setting varieties, these choices of the dependent and independent variables also make it difficult to generalize the study results to other reading conditions.

Additionally, the measures employed to assess comprehension are also varied. Most of the reviewed studies used multiple choices, and some other employed open-ended questions and recall essay. Since reading comprehension involves the reader, the text, and the activity, employing a single assessment only cannot capture a student's comprehension. Therefore, multiple formats of assessment use are needed to assess comprehension more adequately.

The next factor which probably contributed to the conflicting results of the studies focusing on the effect of reading digital texts versus printed texts to reading comprehension is the participants' mastery of digital text reading strategies. Studies have shown that different reading requires different strategy use. Burbules (1998) posited that reading is affected by its contexts and social relations, and differences in those contexts and relations necessitate reading strategy adjustment. Contrasting to the

printed text which is linear and static, digital texts are multimodal and not in a constant state. Digital texts include texts, static images, animations, hyperlinks, and embedded videos and sound. They are not in the constant state because their shape, size, location, and text color (particularly those belonging to web text), can be altered. Due to these, digital reading requires strategies that are never used to read printed texts.

Studies have revealed that many of print reading strategies are also employed in reading digital texts. However, due to the differences between the two media, print literacy does not automatically transfer to digital literacy (Murray & McPherson, 2004). Digital reading necessitates the traditional print reading strategies be employed in a more complex way (Afflerbach & Cho, 2010). Schmar-Dobler (2003) listed seven comprehension strategies consistently employed in both printed text reading and online reading: activating prior knowledge, determining important ideas, asking questions synthesizing, monitoring comprehension, repairing comprehension, and drawing inferences. In addition to these seven strategies, she added "navigating", a unique strategy in online reading, Callister and Burbules (1996) added another additional strategy uniquely used in digital reading called 'surf'. A reader uses this strategy to read web text for searching through a large volume of information quickly. This strategy is conducted by skimming the text to find keywords, phrases, or links without attentively reading line by line. The need for some reading skills uniquely required in digital reading has been confirmed by various studies (Cho, 2014; Coiro, 2011; Dail, 2005; Dalton & Proctor, 2008). To engage with digital texts, readers should be able to use digital reading strategies to navigate, surf, and scroll to search for and locate texts, and to construct and examine meaning by skimming, scanning, note-taking, summing the information, and referring to previous knowledge.

Most of the studies reviewed in this article reviewed did not put the participants' familiarity with digital reading strategies into consideration. Consequently, the experimental group in these studies engaged with the treatments, i.e. digital reading task, without any prior preparation related to digital reading strategies. Some studies (Mangen et al, 2013; Saeidi & Yusefi, 2012) put pretests for homogenizing the participants. But these pretests were reading comprehension and had nothing to do with digital reading strategies. Consequently, the studies were more profitable for paper-based reading, as the participants were more used to read and study with printed-texts. Ideally, the member of the experimental groups should have been trained with digital reading strategies they required in engaging with the treatment. Did the absence of digital reading strategies preparation among the participants before they engaged with the experiments cause digital reading inferiority in some of the studies? Further studies are needed to answer this question.

In addition to the study design variety, the various advancement levels of the technology employed in the study might also contribute to the studies' results inconsistency. The majority of the studies conducted before 2010 (Liu, 2005; Macedo-Rouet et al., 2003; Noyes & Garland, 2003; and Wayne, 2003) showed print reading superiority over digital reading, and one study (Grimshaw et al, 2007) showed no significant difference between the two modes of reading. Due to the high acceleration of technological development, digital reading tools are likely to be quickly outdated. Thus,

we can speculate that since the digital reading tools employed in the studies conducted before 2010 were simpler than those employed after 2010, they might have also contributed to digital reading results inferiority in the earlier studies. Since the technology of digital reading tools has considerably advanced in recent years, more future studies are needed to get up-to-date information about the impact of digital reading technological advancement on reading comprehension.

CONCLUSIONS

The reviewed studies have not yet given a conclusive agreement about which is more effective, print reading or digital reading. Some studies showed print reading outperforms digital reading in terms of comprehension. Some other studies revealed insignificant differences between the two modes of reading, while some others showed digital reading superiority over print reading. The discussion in this article identifies two types of factors attributed to the contradictory results. First, the varieties of the designs of the study. The varieties occurred in the heterogeneity of the subjects' age-group and sample size, settings, independent and dependent variables, measures, and inappropriate mastery or even absence of digital reading strategies among the participants. Second, the various advancement levels of the technology employed in the study. The accelerating advancement of technologies used to facilitate digital reading makes quickly outdated. To obtain a more conclusive agreement about which is more effective, print reading or digital reading, many more studies carried out with more homogenous subjects, larger samples, appropriate settings, controlled variables, and reliable and valid measures are needed. These studies should also employ the latest version of the technology used to facilitate digital reading.

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