






To read on-screen or printed texts? A quantitative study into EFL students' reading achievement

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ABSTRACT

The aim of this study was to compare the EFL students' reading achievement between reading on screen and printed text. This study used a quantitative research design. The participants of this study were 60 students from two classes who took an English education major. The students were randomized into two groups. The experimental group read on screen and the control group read on printed text. The instrument of this study was a news article with 10 multiple choice questions and 10 true-false statements adopted from Breaking News English with the title "Dietary Supplements" by Sean Banville. To analyze the data, the researchers used Independent Sample T-test. The findings revealed a significant difference in students' reading achievement based on the mean score of both groups. The mean score of the experimental group was 85.33 while the mean score of the control group was 75.00. Then, the result of Sig. (2-tailed) value showed that p value, 0.008, was lower than α 0.05, ($0.008 < 0.05$). Hence, it can be concluded that the EFL students who read on screen scored higher in reading achievement than the EFL students who read printed text. The overview of this current study on reading theory, media used, the material given, and reading screen versus paper research, may enable to help teachers and lecturers to make a consideration for their teaching reading in the classroom.



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1. Introduction

Expanding the infancy of the modern machinery 4.0 era, the world becomes more constructive because of these proliferations; nonetheless, the extension of technology preserves the process of the past. Technology has been developing vastly to recognize a lot of diverse information in this entire world. Digital media such as a mobile phone which is more prevalent through the development of technology provides numerous purposes for reading experiences in English as a foreign language (EFL) learning [1]. The digital surroundings which obtained an interest in the development of technology brought out a dissimilar perspective to the reading experiences of individuals and also gave a different dimension to the terms of reading. This difference leads to the transition from the usual types of reading such as printed text to the new types of reading text; on screen via mobile phone. The recent transition from reading paper-based to reading on a screen that influences positive learning outcomes has increased the number of practical studies over a couple of decades [2], and the elucidation of how the outcomes of reading media ups and down over generations were based on the studies' publication [3].

In addition, it is widely confirmed by the researchers in their research studies related to investigating the phenomena of reading on screen and conventional reading using printed texts [3]-[6]. Reading digitally via mobile phone is recognized as an efficient tool for readers [7] and has the possibility to support the learning process in modern ways [8]. Moreover, many experimental research studies concerning both children [9], [10] and adults [11], [12] and a sequence of meta-analyses [13]-[16] have been organized to address this topic. Largely, they suggest that reading on screen has the potential to raise the learners' reading motivation, achievement, and behavioral engagement.

As a result of studies, many researchers have been extensively emerging interests in the implementation of reading on screen and printed text in varied contexts. The results also distribute complex viewpoints and thoughts on the effect of reading in different ways. In a current study, Taky-Eddine and Madaoui [17] investigated Moroccan EFL university students' attitudes toward reading on screen versus print. The samples were 212 Moroccan EFL learners. Overall, they found around 90% of the participants like to read on screen more than print out. The reasons why the participants prefer reading on screen due to ease of access, availability, cost, and enjoyment. Although most of the participants showed positive attitudes toward reading on screen, they still had some weaknesses like reading speed and health factors. Second, exploring the influence of reading narrative texts through paper versus on screen was done by Schwabe et al. [18]. This study consisted of 207 participants and the researchers set as natural as possible the situation during the process of reading the texts. The findings showed that no significant differences were found between the participants who read the texts on screen and the individuals who read conventionally. In addition, reading on screen and paper did not have any impact on the readers' emotional feelings and mental reading aspect.

Furthermore, Sidi, Ophir, and Ackerman [19] studied the effectiveness of medium, screen versus paper, in reading performance. Two hundred and four undergraduate students were employed in this study. Surprisingly, the results implied that no main impacts were attained by the use of medium (screen vs. paper) on participants' reading performance. Even though, in the observations, the participants expressed a preference for paper rather than the screen. It is necessary to highlight that even though the population has a preference for paper, the participants were almost equally the same in reading performance. In a Korean EFL framework, Yeom and Jun [20] explored the comparison between reading on paper and digital-based. There were eighty-four EFL Korean learners participating in this study and they were divided into three classifications; low-intermediate (27 learners), mid-intermediate (29 learners), and high-intermediate (28 learners). The findings showed that among the two groups, electronic-based and paper-based reading achieved reading scores similarly. It means that there were no significant differences between the students who read on paper and the students who read digitally.

Chen and Lin [21] investigated the effect of distinct text displays on reading comprehension through mobile devices. Twenty graduate students aged around 23-26 years old were chosen to participate in this work. They found that reading context and text display for mobile reading did not significantly influence the students' reading comprehension. Moreover, focusing on mobile reading while sitting was primarily better than standing and sauntering. Lastly, in a meta-analytic research study on the impact of reading instruments, digital versus paper, on reading comprehension, Delgado et al. [3] observed 38 research studies conducted from 2000 to 2017. This meta-analysis work revealed significant findings: (1) the advantages of reading paper-based across studies were consistently increased over the years, (2) reading comprehension outcomes who read on paper were higher than for the individuals who read digital-based devices. Although the results suggested that reading paper-based was preferred over reading on screen, it did not recommend avoiding reading through digital devices. Besides, some implications also happened in some research studies such as numerous possible obstacles in operating the device, the compatible devices, and experience in using the medium.

As seen in the previous studies, the field of reading through different media, on screen versus on paper, has not received in-depth attention. Further empirical research is required to explore the effectiveness of using mobile phones in EFL reading [22]. Additionally, the reading medium is necessary and claimed as a crucial variable which gives impacts reading performance [3], [12], [13], [23]. Therefore, the researchers tend to conduct an experimental research study to examine the impact of reading media on college EFL learners. Specifically, this recent study has a goal to distinguish the

EFL learners' reading achievements when they read on screen and printed text.

The present study was guided by the following research question:

Do the EFL learners who read on screen score better in reading achievement than the EFL learners who read printed text?

2. Literature Review

2.1. Reading in English as a Foreign Language

In the 21st century, there is no consideration anymore that reading is a serious life skill [24] and the most precarious ability for EFL learners [10]. Therefore, it is challenging to read and comprehend the texts in English as a foreign language. Technically, the students can enhance their reading comprehension skill through their regular reading practices [25]. In general, reading is not only about transferring what the students have read but also the students are able to interpret the main idea and comprehend the meaning of the text itself. Besides, Kazazoglu [26] described that reading is a fundamental language skill to develop literacy and enables students to comprehend the discourse in a language. Theoretically, comprehension behaviors mostly implicate reading textbooks, giving some responses, finding main ideas, creating opinions, and constructing a summarize what have been understood [27]. Thus, the students need to focus and achieve the reading skill in literal sense, and the capability to read deeply qualifies the students to keep the information longer [28]; although, reading in deep is thoughtful [24].

2.2. Reading on Screen and Texts in English Language Learning

Does medium matter? The question does not have a simple answer. The issue of EFL learners' reading performance through media has fascinated significant interest. Baron [24] noted that for more than 20 years, many researchers have been conducting experiments, spreading questionnaires, and interviewing students around the world related to reading on screen versus printed texts, and the results are still debatable. Starting from digital reading, numerous scholars have believed that reading through digital media, reading on screen, is a beneficial factor to increase reading performance [29], [30], [31]. Moreover, Nikolopoulou et al. [30] mentioned that ICT was an efficient device to encourage the students' reading skills in English as a foreign language. Technologically, through digital reading, EFL students could increase their interest, and be noted as an important aspect of learning from reading text [32], also reading on screen is more available, convenient, and environmental than printed text [33]. A study conducted by Kretzschmar et al. showed that adult learners got faster in reading on screen than reading on paper [11]. Singer and Alexander [34] described that the students clearly preferred reading digitally to printed text, and also naturally expected better reading comprehension. Besides, Walsh [28] mentioned that digital reading encourages the students' enthusiasm to read more and more. Thus, reading on screen could be an effective way to achieve reading comprehension better, and also the EFL learners can highly be motivated to complete the reading task practically.

On another side, many students prefer to read printed texts and are not familiar with reading on screen. Meta-analysis studies conducted by Clinton [13], and Kong et al [35] confirmed that the participants who read on paper comprehended better in reading than those who read on screen. Further, Halamish and Elbaz [36] and Stole et al [2] compared the children's reading comprehension through paper and screen, and it was found that they got better average scores through paper version than the digital type. Next, Yu et al [1] mentioned that EFL learners achieved superior reading comprehension accuracy when reading on paper than when reading from mobile phones. It is strengthened by Mangen et al [37], who found that high school students achieved better reading comprehension scores when reading in print than digitally. Further, Mangen and Kuiken's [38] results were still consistent to compare reading performance across reading media. In their study, the participants got a higher level of narrative coherence in print than reading on screen. Those findings indicated that reading from printed text still became a consideration as an effective medium for the readers. In terms of perception, commonly the students have fewer attitudes toward digital reading [39][40]. Frequent learners preferred to choose reading academic fields through printed texts [41]. Generally, the students are confident to use the electronic pattern, but some choose conventional form as the best medium for academic study [42] since reading on screen is tough for long texts and exhausted the students' eyes [26].

Surprisingly, in fact, some studies also reported that there were no significant differences in terms of reading performance between reading on screen and paper (for instance, Ben-Yehudah, & Eshet-Alkalai [43], Eden & Eshet-Alkalai [44], Fesel et al. [45], Sheen, & Luximon [46], and Young [47]). They were surprised for their findings were in contrast to many previous research studies. In other words, the reading media, on screen and paper, did not give any significant impacts on students' reading comprehension. Even though their findings yielded no significant differences, another result analysis occurred in their study like the participants still got faster completing reading tasks when reading on screen than reading from paper [43].

3. Method

3.1. Design

This study implemented a quantitative research design, ex-post facto research strategy, to measure the data, and aimed to compare the effectiveness of reading media used, print versus on screen, in the EFL learners' reading achievements. The quantitative trait here absorbed gathering data regarding the students' reading scores across reading media [1]. The reading medium (on screen versus printed text) was the independent variable, and the dependent variable was the students' reading achievements.

3.2. Participants and Instruments

In total, sixty EFL learners, class C and D, were chosen as the participants in this research study. The participants were all taking an English education major in a private university in Malang, East Java, Indonesia. The two classes were assigned to the experimental and control group. The researchers here selected the samples randomly by reason of availability to contribute the process of collecting data completely [20], [48]. It also happened in a study conducted by Clinton [32], where the samples were assigned at random. Therefore, the students of class C were designated as the experimental group while the students of class D became the control group. In the experimental group, the students read the text and answered the questions of the test on screen whereas the control group was on paper. Further, to measure the EFL students' reading comprehension, the instrument was adopted from *Breaking News English* with the title "*Dietary Supplements*" by Sean Banville and the objective questions were also taken from the source, *BreakingNewsEnglish.com*. The text had 300 words, 10 multiple-choice questions, and 10 true-false statements. This intermediate-level passage was selected as the instrument since it was the most suitable text for the college students.

3.3. Data Collection and Analysis Procedures

To gain complex data, first to measure the equal ability of the participants between two classes, the researchers collected the EFL students' reading test scores from the lecturers in the class, then the main data were obtained through reading tests, print, and on screen. Technically, the researchers collected all the data by distributing the research instruments using Google Form's link for the experimental group and printed text on a piece of paper for the control group. Afterward, both groups were given 45 minutes to do the test. The last after collecting the main data, the researchers measured in the form of quantitative data using an independent sample t-test. It is in line with the study conducted by Yu et al where they analyze the data obtained using an independent sample t-test to compare the results [1]. The SPSS statistical program was used to analyze the results and the significance level was set at 0.05.

4. Results and Discussion

To respond to the research question in the current study that is investigating the effect of reading media on the EFL learners' reading achievement, statistical analysis, the homogeneity test, the normality test, and the independent sample *t*-test were engaged to explore the data obtained from reading comprehension scores. The results of the differences in the reading comprehension scores across the media are offered in this [Section 3.6](#).

4.1. Test of Homogeneity

To verify the equality of the participants from the two classes, the researchers conducted a test homogeneity through SPSS v.20, Levene Statistic. The use of the Levene statistical table was to determine the significant differences in the competence of the two groups. If the *Sig.* value is bigger than 0.05, which indicates a homogeneity. While if the *Sig.* value is smaller than 0.05, it does not

show any homogeneity. The result showed that the *Sig.* value was higher than 0.05. It signifies that the EFL students from the two classes were homogeneous.

As seen in the table above, the participants of both groups were identical. As presented in Table 1, the sig. value was .561, and it was bigger than 0.05. Technically, from the analysis above, the result of the data could be said as homogeneously distributed data. In other words, it confirmed that there was no significant difference between the two classes (reading on screen and reading printed text). In consequence, this perceived that the two classes were equal (equivalent).

Table 1. The participants' homogeneity variances

	Test of homogeneity of variances			
	<i>Levene Statistic</i>	<i>df1</i>	<i>df2</i>	<i>Sig.</i>
Reading achievement	.342	1	59	.561

4.2. The Normality Test of the instrument

The instrument was designed and composed to determine the effect of reading on-screen or printed text on the learners' reading comprehension performance. In this recent study, the researchers employed twenty objective test items, and to keep the objectivity of the performance of the test, the researchers verified the reliability and validity of the academic test. Furthermore, Hughes [49] mentioned that an instrument of the test can be said a valid test when it measures what it wants to be measured. Thus, to verify the normality, reliability, and validity of the test, the researchers used ANATES ver. 4.0.9. The coming table resulted in ANATES.

Table 2. The reliability of test items

Reliability Test	
Mean	16.45
Standard Deviation	3.06
Correlation XY	0.57
Reliability Test	0.73

Based on Table 2, it resulted in 0.73 for the reliability test. The result indicated that twenty items of the reading test were scaled high or strong. The data can be stated in the scale of medium in the range of 0.40 – 0.59, the scale of high or strong in the range of 0.60 – 0.79, and the scale of very high or very strong in the range of 0.80 – 1.00. Therefore, the test items were included in the high scale or strong reliability that the instrument given was appropriately used to measure the students' reading comprehension. Next, the instrument was valid if the significant correlation score was higher than 0.05. As seen, the score of significant correlation was 0.57 which is bigger than 0.05. Consequently, it can be affirmed that the test items were valid. As a result, the researchers can determine that the test items used were valid and reliable.

4.3. EFL learners' reading comprehension scores across the reading media

To detect the effects of the two-reading media (on screen and printed texts) on the EFL learners' reading achievements, the researchers used descriptive statistic analysis and an independent sample *t*-test. The difference means score between the students who read on screen and the students who read printed text in the reading comprehension test was calculated. The analysis showed that the students' reading comprehension scores were significantly greater for reading on screen ($M = 85.33$, $SD = 12.101$) than for printed texts ($M = 75.00$, $SD = 16.713$). 3 presents the result of the analysis.

Table 3. Means of the students' reading comprehension scores

Treatment order	N	Group Statistics		
		Mean	Std. Deviation	Std. Error Mean
Reading on screen	30	85.33	12.101	2.209
Reading on printed text	30	75.00	16.713	3.051

Comparing the mean scores from the two groups and having 10.33 mean score differences as presented in Table 4, it revealed significantly different between the students who read on screen and the students who read printed texts. In summary, participants' average reading comprehension scores on screen were significantly bigger than that from the printed text when they were ordered to complete the reading comprehension test. Theoretically, the significant difference in the mean scores might be indicated that reading digitally had a significant influence on students' reading comprehension. Thus, the researchers could imply that reading on screen gave a significant impact on the students' reading comprehension performance than the students who read printed text based on the differences in the mean scores.

Table 4 determine the equality differences between the EFL students' reading achievements across reading on screen and printed text, the researchers calculated the data obtained using an independent sample *t*-test. The analysis generated positive effect of reading medium ($F = 8.677$, $t = 2.743$, $p = .008$). The undermentioned table showed the result.

Table 4. The result of the independent sample *t*-test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	8.677	.005	2.743	58	.008	10.333	3.767	2.793	17.874
Equal variances not assumed			2.743	52.852	.008	10.333	3.767	2.777	17.890

As seen in the Table 4, the researchers calculated the data obtained using an independent sample *t*-test to assess whether there is a significant difference or not. Based on Table 4 above, the analysis revealed that the *p*-value was lower than 0.05 ($.008 < 0.05$). Since *p*-value (.008) obtained less than 0.05, this confirmed that there were significant differences at the significance level of 0.05. This finding implied that the reading medium had significant effects on increasing the EFL learners' reading achievement. Thus, the researchers can conclude that the EFL learners who read on screen achieved better reading comprehension scores than the EFL learners who read printed text. In other words, reading on screen led college students to achieve higher scores or better performance in reading comprehension.

The primary goal of this current study was to investigate the impact of reading media, on screen and printed text, on EFL learners' reading achievements. In general, the results proposed that the participants attained better reading comprehension scores when reading on screen than when reading from printed text. In other words, reading on screen affected the EFL learners' reading achievement more significantly than those who read on paper-based. It is debatable that paper reading was believed by some scholars [1], [3], [50]-[52] in their research studies as an efficient medium for reading. They found that the learners who read the printed text would face fewer learning barriers than the learners who read on screen such as highlighting practicality, tiredness, eye strain, disruption, a lack of summary, unsatisfactory notes, and imperfect navigation qualities. However, this present study is inverse to them where reading digitally is better than reading printed text. As stated by Nelson [53] that digital reading will rapidly substitute conventional or paper reading right away; consequently, people would be reading from the screen regularly. Thus, this current study correlates with his viewpoint and has demonstrated that EFL college students have acquired better reading performance when reading on screen.

There are some probable factors affecting this recent study that the EFL learners on the screen scored significantly higher on reading comprehension tests than those in the print condition. Considering the length of the text, the compatibility of the tools used, and the experience in using the mobile phone might lead to the differences in reading comprehension between screen and print. The text length could cause the students' reading performance when reading on screen. The longer a text is, the more uncomfortable the reader on screen is [54]. In this current study, the researchers provided only 300 words length of text, and it was not as long as the instrument used by Yu et al [1] with 658 words. While compatibility and experience operating the mobile phone, it is no doubt that college students have well known how to operate the mobile phone, especially for digital reading [55] since in some cases, many college students have started to use electronic reading experiences as the substitution of traditional printed texts [56]. Moreover, mastering the features and functions of mobile phone itself is essential for successful digital EFL reading [1]. Even though the reading ability of the learners is good enough but the skill in operating the device is not worthy, it might cause some errors in reading test performance.

Furthermore, this present result study was consistent with some results of previous studies [56]-[61][62] that the students accomplished better reading comprehension or favored reading on screen than printed text. This finding supported the study of Alsalhi et al. [56] that electronic reading text had an important role in enhancing undergraduate students' reading achievement. Besides, an experiment by El-Attar [57] also critically matched this recent result study that reading on screen not

only helped the students understand the text like diagrams easier than reading printed text but also decreased the reading errors of the students. The findings complemented Lin [62], who revealed that the students who read on screen achieved better comprehension and scored higher in reading proficiency. Similarly, Jan et al. [58] who mentioned that the students in digital novel reading had significant improvement in reading comprehension performance. Followed by Lysenko and Abrami [60] who found out that a digital portfolio offered greater learning improvements in reading comprehension for participants. While regarding recall memory when reading digitally, Menhaz et al. [61] noticed that the students performed greater when reading on screen, and the memory recall from reading on screen was significantly better than reading printed text.

Next, Concerning the option of using on-screen or printed materials, Ji et al. [59] reported that most of the participants preferred to have the materials given presented electronically than printed text. The survey reported that 56.4% of the total participants preferred electronic readings. These preferences were caused by several factors such as advantages, cost-effectiveness, and practicality. Moreover, Ni'mah and Umamah [63] also found a similar finding in their study that reading digitally offered huge advantages for the students such as practicality, flexibility, easiness, and affordances. Thus, reading digitally affected positively the students' responses and performance. Constantly, it is strongly believed based on the statistical analysis that reading on screen has a significant impact on EFL learners' reading achievements. This current result study strengthened and clearly had some similarities with the previous research studies that the implementation of technology for reading could affect language learners' performance. All in all, the researchers affirmed that reading on screen was useful for increasing the EFL students' reading achievement.

5. Conclusion

This study endeavored to investigate the effectiveness of using reading media, on screen and printed text, in EFL students' reading performance. The results revealed that the EFL college students who read on screen significantly achieved better reading comprehension scores than those who read printed text. It implied that reading digitally gave a more significant impact on EFL students' reading achievements than reading paper-based. Moreover, this result influences the growth acquaintance of college EFL learners' reading achievements of the reading media, on screen and printed text. Over identification of how these influences are integrated, a better understanding of EFL students' reading development with different media can be succeeded. In general, this research's finding proposes that the students had greater reading comprehension achievement when reading on screen than when reading from paper. Hence, more perceptive conclusions can be formulated concerning how to train the students to read using different media based on the reading commission and EFL students' involvement.

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- Author contribution** : AJR conceived of the presented idea, performed the analysis, and wrote the manuscript; DRW and DN verified the statistical analysis and improved the theory; MFU helped supervise the project, analyzed and discussed the findings, and wrote the manuscript.
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