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Effectiveness of Printed and Digital Text on Reading Comprehension of Grade 10 Students

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Abstract
The study determined the effectiveness of printed and digital text on reading comprehension of Grade 10 students. The study was anchored on the simple view of reading (SVR) model and on the perspective of top-down and bottom-up models of reading. A quasi-experimental design was employed collect data on the cause and effect of the dependent and independent variables, utilizing a test questionnaire to gather data from the 40 grade 10 students of one national high school located in Santa Rosa City, Laguna, Philippines. The study revealed that the majority of the participants in the control group (printed text) achieved high proficiency compared to the experimental group's (digital text) in the pretest and posttest score. This finding suggests that printed text might still be more effective for deeper comprehension and memory retention than digital text. However, there is a lack of a significant difference between the post-test score and the pretest score, suggesting that there was some improvement as a result of both printed and digital text. Nevertheless, neither printed text nor digital text clearly outperformed the other, even with the rise in competence level. In addition, a comprehensive action plan was recommended to provide the students with opportunities to develop and strengthen their literacy skills by using both printed and digital text reading formats. There is a need to strengthen student's reading strategies and digital literacy to maximize comprehension across mediums to provide students with opportunities to enhance their literacy skills through both printed and digital reading formats since students using printed texts showed a greater percentage improvement in high proficiency levels despite digital tools being convenient. This quasi-experimental study determined the effectiveness of printed and digital text on reading comprehension of Grade 10 students. It is beneficial in order to optimize understanding across media, students' digital literacy and reading strategies.

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1. Introduction

Reading is the primary resource of learning without strong reading ability, learning will become more challenging. Reading is one of the fundamental skills that one must acquire because most of the information is delivered through written or text (Idulog *et al*., 2023) [31]. There are various reasons on why people read in day-to-day life. According to Pradani (2021) [51] some people read for enjoyment or leisure but for some they read for the thirst of knowledge. Numerous benefits of reading include improvements in emotional intelligence and general wellbeing. It also enhances cognitive development, specifically the critical thinking of a person by analyzing, interpreting, evaluating and making a judgment about what they read, hear, say or write. Good critical thinking can be able to judge the reliability of the information provided. Critical thinkers are able to interpret information and are able to break down information to the simplest form that is easy to understand. Based on the newly released report of

the Program for International Students Assessment (PISA) conducted in 2022, the Philippines ranked second to last when it comes to creative thinking. The Program for International Students Assessment (PISA) test result is essential as high rank on PISA is associated with economic success, not just economic success but according to studies, PISA is one measure of how well educational systems are preparing pupils for the global knowledge economy of the twenty-first century (Chi, 2023) [17]. There is not much difference between the score of the Philippines in 2018 and 2022 PISA results and that is the reason why it is essential to address this problem as it will impact every aspect of learning and daily life. Emphasizing on assessing the effectiveness of reading using both print and digital text in improving the reading comprehension of the students in the Philippines. Bresó-Grancha *et al*. (2022) [11] stated that reading in print is superior to reading in digital because those who often read in print texts are less likely to perform multiple tasks during reading than those who often read on digital screens. Pardede (2019) [50] argue that reading is a crucial skill that every learner must master. To facilitate this process, printed books have proven to be quite helpful. But the flood of digital books today has fundamentally changed the reading habits of learners. Integrating print and digital in reading meets the various reading preferences and demands of the learners. When using print materials for reading, it is usually preferred for fewer distractions and promotes more concentration, while the digital versions offer accessibility and convenience, making them ideal for mobile learning. Many researchers firmly believe that the integration of both print and digital mediums is an effective approach to learning, as both reading mediums provide a well-rounded educational experience that caters to various learning styles and preferences. While numerous research studies have explored the effectiveness and challenges of various reading mediums such as text and print, no study has examined the reading comprehension of the students of a national high school in Santa Rosa City, Laguna, Philippines. Specifically, it sought to analyze how printed and digital text affect comprehension. The comparison of both formats aimed to determine which format better supports comprehension, as well as whether printed and digital text affects reading comprehension. The study's findings not only address current educational challenges but also provided a structured and evidence-based approach to understanding their impact on learners in diverse learning contexts.

2. Theoretical Framework

The Simple View of Reading (SVR) model of Wesley A. Hoover and Philip B. Gough as cited in Sánchez-Vincitore *et al*. (2022) [64] served as the theoretical foundation of the study. This states that both decoding and linguistic comprehension are necessary for skilled reading. According to Hoover and Gough, reading comprehension involves two things: converting the letter into sounds, thus combining this into words (decoding), and the capacity to comprehend the many components of spoken or written language (language comprehension). They added that a second basic assertion of the simple approach is that both decoding and linguistic comprehension are necessary for reading success, with neither being sufficient in isolation. Sánchez-Vincitore *et al*. (2021) study indicated that word recognition and language understanding account for 80% of the reading comprehension variance, thus making SVR a valid model for understanding reading comprehension.Also, this study is anchored in the perspective of top-down and bottom-up models of reading cited by Yusof (2021) [44]. According to the researcher, top-down processing is characterized by perceptions that begin with the broad and progress to the more detailed. Expectations and prior knowledge strongly influence human views and perceptions. Simply said, the human brain uses what it already knows to fill in the gaps and anticipate what will happen next. With virtually limitless sensory experiences and information available to everyone in today's world, top-down processing can assist people in making sense of the surroundings more quickly and efficiently. The graphic, syntactic, and semantic cue system provides only the necessary information for comprehension. Bottom-up approach in reading on the other hand is a step-by-step process of reading. It begins with phonics and phonemic awareness. It teaches learners to construct meaning from the most basic units of language, including letters, letter clusters and words. In order to understand a text, learners must first analyze the basic unit of language. Yusof (2021) [44] explained that bottom-up processing begins with minor sensory details, which are subsequently used to build larger concepts or perceptions about the surroundings. Nadea *et al*. (2021) [47] argue that this strategy is described as a procedure that incorporates perceptual accuracy, sound, and the ability to discover a series of texts, words, spelling patterns, and other language units. Readers attempt to comprehend the text by constructing meaning from the smallest to the greatest components. Readers try to understand the text by building up its meaning from the smallest to the largest units, then changing what they already know and guessing what will happen next.

3. Methodology

3.1 Research Design

The study employed a quasi-experimental design to collect data on the cause and effect of the dependent and independent variables. According to Thomas (2024) [69] quasi-experimental design aims to establish a cause-and-effect relationship between an independent and dependent variable. This design was used to know the effectiveness of the reading text, such as print and digital, on the reading comprehension of grade 10 students. There are independent and dependent variables in this study. The independent variables were the two reading text formats (print and digital), and the dependent variable was the participants' reading comprehension.

3.2 The participants and setting of the study

The primary source of data are the 40 randomly selected grade 10 students of a national high school in Santa Rosa, Laguna, Philippines. They belonged to the same reading level on the PHIL-IRI results (instructional level) where the students got a 59-79% comprehension score divided into two groups with 20 participants in the control group (printed text) and 20 participants in the experimental group (digital text).

3.3 Instrumentation And Validation

The researchers provided a test questionnaire with a 15-item test for the pretest and another 15-item test for the posttest. Each questionnaire featured a short story that aligned with the most essential learning competencies (MELC), aiming to equip students with the necessary competencies and skills for the procedure. Below the story, participants were required to

complete a quiz based on the short story they have read. Three questionnaire and the story are written in English, and the questionnaire consists of 15 questions with 3 levels of difficulty (easy, moderate, and difficult) anchored on Bloom's taxonomy of domain to test the reading comprehension of the participants. The researchers also ensured the validity of the test questionnaire content by asking experts to review the test questions. The experts evaluated the content and clarity of the alignment of each item with the objectives of this study, and based on their feedback, the researchers incorporated corresponding revisions. Additionally, pilot testing verified the efficiency of the test questionnaire. The data was gathered before the actual implementation of the main survey. For the reliability of the questionnaire, a Cronbach alpha value of 0.760 was obtained, indicating good internal consistency.

3.4 data gathering procedure

The data was collected in three phases: pre-test, intervention, and post-test. The researchers wrote a letter to the school administration for their permission to conduct the study in their school and a consent form for the grade 10 participants, advisors, and guardians. After getting permission, the researchers randomly selected the grade 10 participants. Each of the 20 grade 10 students received a consent form. The consent form included the purpose of the study, the procedure and its benefits, and an agreement that participation in the study is voluntary. After the researchers received permission from the participants, they notified the participants about the start of the data gathering phase. The study employed a non-equivalent control and experimental group, comparing the outcomes between the control and experimental groups through a pretest and posttest approach wherein the two groups of grade 10 students will be selected as experimental and control groups. There were two groups, with one serving as the control group (printed text) and the other as the experimental group (digital text). Each group was given a pretest exam to measure their reading comprehension. Both the experimental and control groups received the pretest and posttest during the data collection process. The test consists of 15 items aligned to the Most Essential Learning Competencies (MELCS). Each group received an identical text to read during the observation period, which spanned 2 weeks. At the end, the researcher gave a post-test to evaluate the reading comprehension of the participants. This approach was used to answer the research question and hypothesis.

3.5 Ethical Consideration

The study protected and respected the data collected for the research purpose only in accordance with Philippine Republic Act No. 10173 (Data Privacy Act of 2012). The research was conducted in full compliance with ethical guidelines and institutional regulations to ensure the privacy, safety, and well-being of all participants.

3.6 treatment and analysis of data

For this study, the descriptive and inferential statistical methods was used to assess the effectiveness of text formats (digital and print) on reading comprehension of the participants. Frequency and percentage distribution was used to describe the pre-test and post-test performance in reading comprehension of the participants and t-test for dependent and independent samples was used to determine the difference between the pre-test and post-test scores of the participants in the control and experimental groups.

4. Results And Discussions

This study aimed to determine the effectiveness of text format (print and digital) in improving the reading comprehension of grade 10 students in a Philippine national high school. Specifically, it determined the pretest and post-test performance, identified the difference in the pretest and post-test performance and identified the difference between the pretest and post-test performance in reading comprehension of the participants in the control group and experimental groups. Table 1 shows the scores in the pretest performance of the Control Group and Experimental Group. As shown in Table 1, 40 percent of the participants from the control group achieved the high proficiency level, indicating that out of 20 participants in the control group, 8 of the participants got the score between 11 and 15. Moreover, 80% of the participants achieved a moderate proficiency level. This connotes that 12 of the participants from the control group got a score of 6–10 in the pretest, and none of the control group achieved a lower proficiency. As the data indicates that the pretest of the control group has a high number of the participants fell into a high proficiency level. This shows that using printed text is visually less demanding than the digital text as it allows for deep reading without interruptions and it provides spatial and tactile cues to help readers process words on page as what the study of Benson (2020). For the pretest result of the experimental group 35% of the participants achieved high proficiency wherein 7 of them accumulated a score between 11-15. Meanwhile, 12 of the participants got the scores of between 6 to 10 means that 60% of the students achieved moderate proficiency level and only 1 of the participants fell into low proficiency level. The students who were belong to the experimental group find the test difficult and it shows in the table 1, where 5% of the participants scored between 0-5. The pretest result shows that most students in both groups were at a moderate proficiency level with a slightly higher number of students in the control group using printed text reaching high proficiency. This supported the study of Jeong and Gweon (2021) [34] where the study revealed that reading performance, as determined by reading comprehension and reading time, was equal across different mediums; however, readers reported higher levels of comprehension when reading printed text as opposed to reading from a device screen.

Table 1: The Pretest Performance in Reading Comprehension of the Participants in the Control Group and Experimental Group

Score	Experimental Group		Control Group	
	F	%	F	%
High proficiency (11–15)	7	35	8	40
Moderate proficiency (6–10)	12	60	12	80
Low proficiency (0–5)	1	5	–	–
Total	**20**	**100**	**20**	**100**

Table 2 shows the difference in the pretest performance of the participants in the control group and experimental group. It can be drawn from the data that the computed mean score of the control group is (10.05), which is slightly higher than the experimental group (9.45). The results show that both groups had similar reading comprehension skills before the intervention. This is because the participants were chosen at random from the instructional level on the PHIL-IRI reading comprehension test. The t-test value (-0.982) and p-value (0.332) indicate that the difference between the control group (printed text) and experimental group (digital text) is not statistically significant ($p > 0.05$). This data suggests that there is no difference between their initial score before the intervention. Other recent studies have found no significant comprehension differences among participants who read either print or digital text, as stated in the study of Çınar *et al*. (2021) [18].

Table 2: Significant difference in the Pretest Performance in Reading Comprehension of the Participants in the Control Group and Experimental Group

	Mean	T-Test	P-value	Interpretation
Experimental Group	9.45	-0.982	0.332	Not Significant
Control Group	10.05			

Sigmificance Lavel @ 0.05

Table 3 shows the scores in the post-test performance of the participants in the control group and experimental group. It shows how well the participants did on a reading comprehension test after the intervention. The high proficiency level rose by more than 70%, where 14 out of 20 participants got scores between 11 and 15 on the reading comprehension test using printed text in the control group. Additionally, 30% of the participants from the control group achieved moderate proficiency; 6 of them got scores of between 6 and 10 for reading comprehension, and none of the control group got scores of 0 to 5 or achieved low proficiency. The people in the control group did well after the intervention, as shown in the table: 70% of them got high proficiency on the posttest. This suggests that they may have kept using effective reading strategies during the intervention, which helped them understand what they were reading better naturally. This is in line with Banditvilai's (2020) [8] research, which shows that reading strategies have a big effect on students' ability to understand what they read. As indicated in the table, the performance of the experimental group was lower than the control group. 45% of the participants achieved high proficiency, and 9 of them got a score of 11-15. Moreover, 9 of the participants got scores of between 6 and 10, which means that 45% of the participants in the experimental group achieved moderate proficiency, and only 2, or 10%, of the participants got a comprehension score of 0 to 5 (low proficiency). The data shown in the experimental group is that they find the test using digital text more difficult to answer, as the post-test performance shows that 10% of the participants have low proficiency in reading using digital tools. According to Ningsih *et al*.'s (2023) [48] study, students may find it challenging to comprehend using digital tools due to the impact of digital textbooks on their ability to focus, as they are easily distracted by social media, notifications, and web browsing. This could potentially explain why the participants' performance on the reading comprehension posttest was poor.

Table 3. The Posttest Performance in Reading Comprehension of the Participants in the Control Group and Experimental Group

score	Experimental Group		Control Group	
	F	%	F	%
High Proficiency (11-15)	9	45	14	70
Moderate Proficiency	9	45	6	30
Low Proficiency (0-5)	2	10	-	-
Total	20	100	20	100

Table 4 shows the difference in the post-test performance of the participants in the control group and experimental group. The difference in the posttest performance in reading comprehension of the participants in the control group and experimental group after the intervention, the control group had a higher mean score (10.95) than the experimental group (9.90) means there is not much of a difference between the posttest performance of the control group and experimental group. The t-test (-1.490) and p-value (0.145) suggest that the differences are not statistically significant. Since the result shown that the posttest performance of the control group and experimental group as not statistically significant this implies that any improvements in reading comprehension were similar in both groups and the intervention did not lead to a significant improvement compared to the traditional method used by the control group. The analysis of Schwabe *et al*. (2022) [61] also found no significant difference in reading comprehension between digital and print text, suggesting that the reading medium (paper vs. screen) does not substantially affect understanding.

Table 4: Significant difference in the Posttest Performance in Reading Comprehension of the Participants in the Control Group and Experimental Group

	Mean	T-Test	P-Value	Interpretation
Experim Ental Group	9.90	-1.490	0.145	Not Significant
Control Group	10.95			

Significance Lavel @ 0.05

Table 5 shows the difference between the pretest and post-test performance of the participants in the control group and experimental group. Data shows that experimental group got (9.45) from the pretest score of the participants to (9.90) post test scores of the participants and the pretest score of the control group from (10.05) scores of the participants to (10.95) which indicates that both control group and experimental group shows improvement in the mean score. However, the p-values (0.398 for the experimental group and 0.257 for the control group) indicate that the differences between pretest and posttest scores were not statistically significant. Both the control and experimental groups' mean scores improved in the pretest and posttest, which indicates the improvement in reading comprehension among the participants, but the difference was not statistically significant. The control group showed a greater increase in high proficiency levels, while the experimental group remained more stable across proficiency levels. The result of this study exposes that the control group (printed text users) had a higher percentage of students reaching high proficiency in the posttest. This suggests that printed text might still be more effective for deeper comprehension. Furthermore, this study agrees with the study of Sage *et al*. (2020), wherein the results showed that students' learning experience with reading in print was superior, with the laptop (digital text) coming in second.

Table 5: Significant difference between the Pretest and Posttest Performance in Reading Comprehension of the Participants in the Control Group and Experimental Group

Exparimental Group	**mean**	**T-Test**	**P-Value**	**Intrerpretation**
Pretest	9.45	-0865		
Pretest	9.90			
Control Group	**Mean**	**T-Test**	**P-Value**	**Interpretation**
Pretest	10.05	-1.168	0.257	Not Significant
pretest	10.985			

Significance Lavel @ 0.05

5. Conclusions

Based on the findings of the study, it can be concluded that a significantly greater number of participants of the control group (printed text) achieved high proficiency level compared to the experimental group (digital text) in the pretest and posttest score. Reading using printed text may have provided certain advantages in reading comprehension. Moreover, based on the mean score of control group, printed text might be providing better focus and retention, perhaps as a result of enhanced cognitive processing and fewer distractions. However, digital text was not as effective as printed text and may require additional support to enhance comprehension skills. The findings also showed that there was an improvement in reading comprehension among the participants, but both formats do not significantly differ in terms of reading comprehension. Based on the findings of the study, it is suggested for language teachers to continuously utilize and integrate both digital and printed text in reading instruction inside the classroom by incorporating different reading strategies using a mix of printed and digital text into the lesson proper to cater to the diverse learning preferences of the students. Meanwhile, school administrators should provide students access to digital reading platforms by making sure that they have all the necessary devices and tools. Also, they should conduct assessments to track comprehension progress on both print and digital platforms and promote teaching strategies to support the students in developing their reading comprehension. Finally, future researchers should further look into how students possess preferences over digital and printed text using their own reading strategies and explore why printed text my lead to high proficiency by considering factors like reading strategies and habits, and explore whether reading comprehension through digital text improves with long exposure to usage.

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