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# The Effect of Students Reading Digital Text Versus Print Text on Comprehension

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The Effect of Students Reading Digital Text Versus Print Text on Comprehension

A Project Presented to  
The Graduate Faculty of  
Minnesota State University Moorhead

By

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### Abstract

This study explores the relationships between the use of digital and print text and its effect on fourth-grade student reading comprehension. The study uses weekly text dependent question quizzes to monitor student reading comprehension within ability groups. Another purpose of this study is to determine if students of different baseline reading abilities perform differently using digital or print text.

Thirty students from a small, public, Air Force Base school, were chosen for the study and participated within their reading groups using either digital or print resources. The results of this study showed that all students, regardless of baseline reading ability, scored better on comprehension tests when taught and tested in print form.

*Keywords:* reading comprehension, digital text, print text,

## Chapter One

### General Problem/Issue

Reading instruction has long been a part of elementary classrooms, and is considered the primary tool for learning in all other subject areas. As technology has advanced and pushed society into the digital age, the delivery in which reading instruction is given continues to change along with it. Today's teachers feel the pressure of adding more and more technology into their daily lessons, to enhance student learning and develop 21st-century skills.

“Few investigations though, have measured the effectiveness of integrating technology on reading comprehension” (Ortlieb, Sargent, Moreland, 2014, p. 397). Teachers wanting to include best practices in their teaching are faced with a plethora of technology options that lack the backing of researched, effective results. E-readers and other digital features of a curriculum are often viewed as fun and engaging, but the question still stands, are they effectively teaching students the proper reading skills needed to comprehend a text?

Knowing that 70% of American secondary students need reading remediation left me wondering if there was a better way to present reading instruction to fourth graders (Biancarosa & Snow, 2006 as cited in Lupo, Jang, and McKenna, 2017, p. 265).

Last year, our district implemented a new reading curriculum that can be presented as fully digital, fully print, or a combination of both. I wanted to know how I should implement the new curriculum to increase the reading level and comprehension of my fourth-grade students. However, information on what was the best way to proceed was not available. It was left open to the teacher's discretion. By studying the effects of using digital and print text, I hope to discover



the benefits and drawbacks of both and have a clear path on how to implement reading instruction in the future.

### **Subjects and Setting**

**Description of the subjects.** Participants in this study attend fourth grade at a small elementary school (275 students) on an Air Force Base in North Dakota. Students range between the ages of nine and ten years. On average they have attended three different schools and lived in four different locations before coming here. There are 30 students in the classroom. Of the 30 students, 18 are girls, and 12 are boys. The population of the classroom is more diverse than the surrounding schools, reflecting the diverse ethnic groups of the military. The population of this classroom as reported by parents is 50% Caucasian, 23% two or more races, 16% Hispanic/Latino, 13% African American, and 3% Pacific Islander.

The students are diverse not only in their ethnicities but in their learning needs as well. One student has an individualized education plan (IEP), in the category of Learning Disability. Three students are on 504 plans. Two students see a speech pathologist; two students are in tier three reading intervention (Scholastic System 44), four students receive Title I look-a-like math services. Three students receive tier one gifted and talented services within the classroom, one student receives tier two gifted and talented pullout services.

**Selection criteria.** Shortly after the start of the school year, the 30 students were split into five reading groups. The groups were homogenous based on baseline reading data from NWEA MAP tests and teacher observation. The groups contained six students. Two lower reading level groups were formed (Groups A and B), two higher reading level groups (C and D), and one average group (E). Throughout the academic year, children moved between groups based upon

progress monitoring through RIGBY and MAP testing as well as teacher observation. However, during the duration of this study, students stayed in their assigned groups.

Due to the transit population of the Air Force, precautions of losing test subjects were noted. All students were selected to be a part of the study, so in the event of students moving, there is still enough data from each group to analyze. Groups A and C received reading instruction and tests solely in digital form. Groups B and D received reading instruction and tests solely in print form, and Group E received a combination of digital and print for both reading instruction and testing. Data will be collected throughout the study to track each student's progression.

**Description of setting.** This study takes place at an elementary school on an Air Force Base in North Dakota with a population of about 5,500 people. The demographics of this school differ from the rest of the district due to the diversity in the military. Current enrollment is 275 students grades Kindergarten through fifth grade. As of April 8, 2019, this school has dismissed 52 students to other schools this academic year and gained 99. 21.3% of the students qualify for free and reduced lunch, 12% are English learners, 8% qualify for special education services, and 0% are currently homeless. Within this population 63.2% parent identify as Caucasian, 16.1% are Hispanic/Latino, 11.6% are Black, 6% are Asian, 1.8% are Native American, and 1.4% are Pacific Islander (Viewpoint, 2018)

**Informed consent.** Permission to conduct this study was obtained from the Institutional Review Board (IRB) at Minnesota State University Moorhead, the Minot Public School district through Tracy Lawson, Assistant Superintendent of Elementary Schools, and Ned Strand, building principal. The school district's IRB procedure was followed as well as the parameters laid out by the district to obtain permission to conduct research.

All students involved in the study were under the age of 18. Therefore permission was obtained from their parents/guardians in written form. The researcher outlined in the permission forms the exact procedures, the purpose of the research, and included a disclosure of risks and benefits. Confidentiality of the students was maintained throughout all areas of the research study including, but not limited to written reports, data sheets, and verbal information. Parents/guardians were given the option to withdraw their consent at any point; they were notified of this through written notification.

**Definition of terms.** For the purpose of this study, the following terms are defined:

Digital text: The electronic version of a text that can be accessed via the Internet, computer, or a variety of handheld devices (i.e., Kindle, Ipad, Nook) (Hardin, S.).

Print text: Images or letters on paper to produce books, magazines, newspapers, etc. (Cambridge University, 2018).

Reading comprehension: Retrieving previously acquired schema to assist in processing and understanding new and unfamiliar information while reading or listening to text (Ortlieb et al., 2014).

### **Statement of Purpose**

The purpose of this study is to determine if digital text or print text has a more significant effect in increasing student reading comprehension.

## Chapter Two

### Review of Literature

We are currently living in an age where information and knowledge are universally available. “A society in which the use of computer-based information systems has penetrated widely into civil lives” (Bando, Asano, & Nqzawa, 2017, p.45). Knowing this, it is no surprise that elementary classrooms have been inundated with technology options to help reach students across all academic levels.

One form of technology that has become increasingly common is digital books or digital print. (Singer & Alexander, 2017) Research has shown that children who learn to read in the early primary grades successfully are well prepared for their following school years. “Learning to read proficiency in the primary grades is one of the cornerstones of academic achievement and the foundation for children’s later success in school” (Stommen & Mates, 2004; Valley & Shriver, 2003 as quoted in Ciampa, Katia 2012, p.14). While knowing how vital reading mastery is in the early grades, 70% of American secondary students need some sort of reading remediation (Lupo, Jang, & Mckenna, 2017, p. 265). The purpose of this study is to determine if using digital text or print text has a more significant effect on a student’s reading comprehension.

**Fatigue in reading and its effects on reading comprehension.** When a student begins to feel tired or fatigued while reading, comprehension recall goes down immensely (Hanho Jeong, 2012). The extra load imposed on cognitive processing systems causes the reader to be more focused on their fatigue than the reading material (Hou, Rashid, & Lee, 2017, p.87). Researchers have found that students have a higher rate of reading fatigue when reading digital text compared to print text (Hou et al., 2017). The American Optometric Association has officially

recognized computer vision syndrome as of 2015. This syndrome is marked by symptoms of eyestrain, headaches, dry eyes, and neck pain. “When reading paper text, the haptic modality might offload some cognitive demands onto the visual modality, thereby alleviating visual fatigue” (Mangen & Schilhab, 2012 as cited in Hou et al., 2017, p.86). When a reader is less focused on their fatigue, more cognitive ability is allotted to understanding the text.

**Importance of creating a mental map when reading.** Being able to visualize what is being read is a crucial part of reading comprehension. It helps the reader create a flow of sequential events that answer important questions such as who did what and where. Without the understanding of these questions, it is nearly impossible for the reader to piece together what is happening in the text (Idol, & Croll, 1987). Researchers Hou, Rashid, and Lee have found that it is easier for readers to create these mental maps when reading print text rather than digital text.

It contends that screens make it difficult for readers to construct an effective cognitive map or a spatial representation of a text. This weak efficiency for assembling cognitive maps, in turn, impress navigational performance, (i.e., searching for or locating a piece of textile information), reading speed, content recall, and reading comprehension (Payne & Reader, 2006 as cited in Hou et al., 2016, p. 84).

**Immersion.** “Immersion refers to the sense of engagement or an experience of losing oneself in an environment” ( Hou, Nam, Peng, & Lee, 2012; Witmer & Singer, 1998 as cited in Hou et al., 2016, p. 88). When a reader becomes lost in a text, higher rates of comprehension have been documented. The reader is able to create mental maps in greater detail, and recall information at a higher rate (Hou et al., 2016). Digital print has been noted as having more distractions than print text that deter the reader from becoming immersed in their reading. “If you don’t

start thinking early about managing distraction, you're going to be building bad habits," (Turner as cited in Heitin, 2016).

Even digital age born students need to learn a host of new skills to operate digital texts (Heitin, L, 2016). Students can become lost in the features of digital texts. For example, scrolling text has been shown to disrupt the reader's ability to sort information correctly (Hou et al., 2016, p. 87). The use of hyperlinks has been shown to cause distractions by creating a less focused reading environment as topics shift. "In a study of university students, Keller found that more effort was required to concentrate on reading from the screen as opposed to print, in part owing to distractions caused by the computer, and in part because students considered online texts to be less authoritative (Keller as cited in Freund, Kopak, & O'Brien, 2016, pg. 81).

Immersion and reading comprehension is also influenced by the reader's choice. A reader is more likely to become immersed and therefore understand a text better when they desire and have chosen it for themselves (Hou et al., 2017). With the introduction of Ebooks and other digital texts "experts expected that print books would fall away, but in a wrinkle in the digital revolution, it hasn't happened yet" (Stoltzfus, K., 2016). Children across the globe have been surveyed, and the results show that even digitally native children, those who were born in the new millennium, prefer print text (Prensky as cited in Institute of Multi-Sensory Education, 2017). In the United States 61% of children ages 9-11 state that they would always choose a print textbook over a digital textbook. Leaving only 39% of children that would sometimes or always select an ebook (Scholastic, 2017). Furthermore, Scholastic conducted studies in both the United Kingdom and Australia and found similar findings. In Australia, only 29% of children aged 9-11 reported even reading a single digital text (Scholastic 2015; Scholastic 2016, as cited in Merga, &

Roni, 2017). One may conclude that this may be because of a lack of digital technology, but researchers have found that the more digital devices available to a student the less likely they are to read on them. The researchers at the Institute for Multi-Sensory Education concluded reading traditional books provides a respite from the bombardment of screens and the distractions that come with them (Institute of Multi-Sensory Education. 2017).

### **Statement of the Hypothesis**

Fourth-grade students who interact with print text during reading instruction will score higher, as measured by weekly unit tests, than those who interact with digital text.

## Chapter 3

### Research Questions

As an elementary teacher, I was overwhelmed with the different options for presenting reading instruction. When I and others on my team inquired about best practices, there were many different opinions about what was best for young readers. I was curious to see if there was a relationship between presenting reading instruction digitally or in print and its effects on student reading comprehension. Because of these wonderings, I formulated these research questions:

1. Will a relationship appear between reading comprehension and instruction between digital or print text?
2. Do students of different reading ability perform differently using digital or print text?

Answering the above questions will help to provide a better understanding of the use of digital and print text in the classroom leading to implementing reading instruction most efficiently.

### Research Plan

**Methods and Rationale.** In order to measure this study, baseline reading data from NWEA MAP testing as well as teacher observation was used. This test measures each student's reading comprehension and assigned a Lexile number to each student. MAP assessments are used district-wide three times a year for grades 2-12 and are reliable. The reliability is .97 and is nationally normed using anonymous data from over 10.2 million students over six million test sessions at 23,000 schools in 49 states (Adam Simpson and Heart, 2019). After analyzing the data from the MAP tests, five homogenous groups were created and consisted of 6 students. Two lower reading level groups were formed (Group A and B), two higher reading level groups (C and D), and one average group (E).



Each week the text dependent quizzes from the curriculum Benchmark Advanced were used to monitor the comprehension of each student. This assessment gave data that was helpful in determining if the student's rate of comprehension was related to the method of instruction. Self-developed data sheets were used to collect data while observing the student's reading comprehension. A trial run was conducted using this method prior to the study, to guarantee it collected the specific data needed entirely. This tool is valid because the content will be measuring the variables listed for the research.

**Schedule.** The research study was administered over an eight week period. The fourth-grade students received direct reading instruction for 45 to 60 minutes a day depending on their small group rotations. Each week new units were started with new stories and comprehension skills.

**Week 1:**

- Get baseline comprehension score for all students.
- Analyze baseline MAP reading scores for all students.
- Inform students of the study and why they will be different groups.
- Make sure technology components work on all student computers and give lessons on how to use the digital components.
- Trial run of observation sheets to ensure all needed data is collected

**Week 2:**

- Unit 6.1 instruction, test, and data collection
  - Groups B, D, E print instruction and testing
  - Groups A, C digital instruction and testing

**Week 3:**

- Unit 6.2 instruction, test, and data collection
  - Groups B, D print instruction and testing
  - Groups A, C, E digital instruction and testing

**Week 4:**

- Unit 6.3 instruction, test, and data collection
  - Groups B, D, E # 6 and 2 only print instruction and testing
  - Groups A, C, E # 3, 20, 17, 30 digital instruction and testing

**Week 5:**

- Unit 7.1 instruction, test, and data collection
  - Groups B, D, E print instruction and testing
  - Groups A, C digital instruction and testing

**Week 6**

- Unit 7.2 instruction, test, and data collection
  - Groups B, D, E print instruction and testing
  - Groups A, C digital instruction and testing

**Week 7:**

- Unit 8.1 instruction, test, and data collection
  - Groups B, D print instruction and testing
  - Groups A, C, E digital instruction and testing

**Week 8:**

- Unit 8.2 instruction, test, and data collection
  - Groups B, D print instruction and testing
  - Groups A, C, E digital instruction and testing

**Ethical issues.** A possible ethical issue that could arise would be students being in a group that receives one type of instruction but wanting to be in a group that has the other. However, there will be times that the student can choose their method of learning in places such as in library class, to decrease the concerns of never getting to do one option. Another ethical issue that may arise is one set of students may flourish more than another group, depending on their instruction. To ease this issue nothing directly linked to this study will be taken into account for their final grading.

**Anticipated response.** If any of the previously stated ethical issues become a problem, they will be dealt with on an individual basis. I have found that explaining to a student why they are in one group instead of another can help immensely in their worries or concerns. Giving the student time to read in their preferred medium may also be considered. If one set of students begins to fall behind academically, lengthy consideration will be given as to why and what can be done to counteract this issues. Changes will be implemented as necessary.

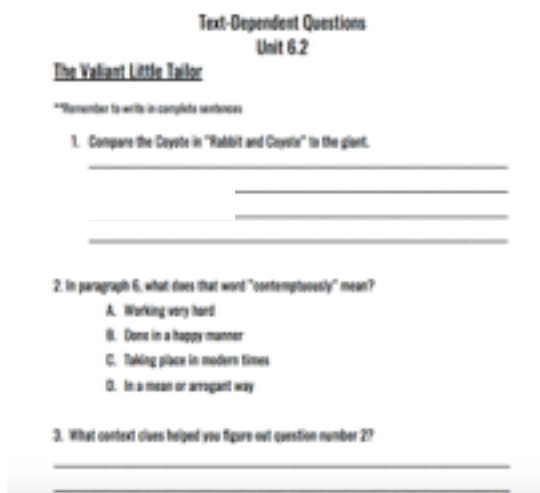
## Chapter 4

### Description of Data

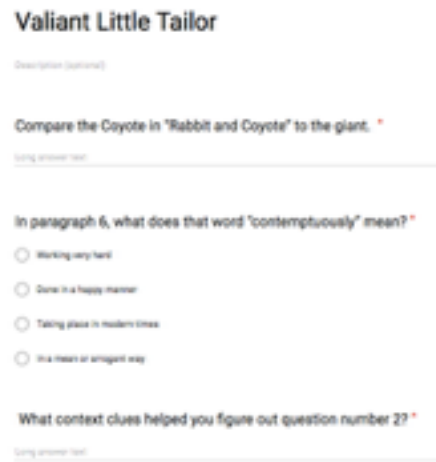
**Assessments** Prior to determining which students would be in each group, NWEA MAP testing data scores were analyzed. Scores from both the Fall and Winter benchmark periods were examined, with the exception of three students who moved into the classroom after the fall benchmark period. Students were grouped by reading comprehension ability, all 30 students were selected to take part in this research study.

Throughout the study, groups A and C received reading instruction and testing digitally. Groups B and D received reading instruction and testing in print form. Group E received both digital and print instruction depending on the week (see schedule). All groups used the weekly reading passages from Benchmark Advanced curriculum, and had their reading comprehension assessed weekly using the text dependent quiz questions. These assessments are quite challenging and are graded on a standard scale rather than the traditional grading system. Meaning that a traditional score of 70% on these quizzes is seen as proficient.

The quizzes are set up with two to four questions per story and assess students on their general reading comprehension. Students answered questions covering various comprehension skills; vocabulary, grammar, main idea, inferences, characters, setting, etc. The questions range from short answer, true and false, multiple choice, and multi-step. Partial credit can be earned on both the short answer and multi-step questions.



*Figure 1.* An example of the print version of the text dependent quiz.



*Figure 2.* An example of the digital version of the text dependent quiz.

**Interpretation of Data** The weekly Benchmark Advanced text dependent quiz scores were analyzed. Charts were created with student data including the number of correct answers, use of complete sentences on short answer questions, and points earned. Examples of these charts can be found in the appendix. Notes about frequent absences were noted and data was not collected if the child was gone (illness, vacation, military leave, etc) for more than three days during a given week. Students that had a permanent station change (PCS military relocation) during the study were also noted on the tables, data was not collected after the student's move.

### Student Growth

The research study assessed student's comprehension ability following instruction in either the print or digital form. The goal of this study was to determine if there was a relationship between reading digital or print text and reading comprehension. Each week students who received

instruction and testing in print form scored higher on the comprehension tests than those who received instruction and testing in digital form. The weekly data is displayed below.

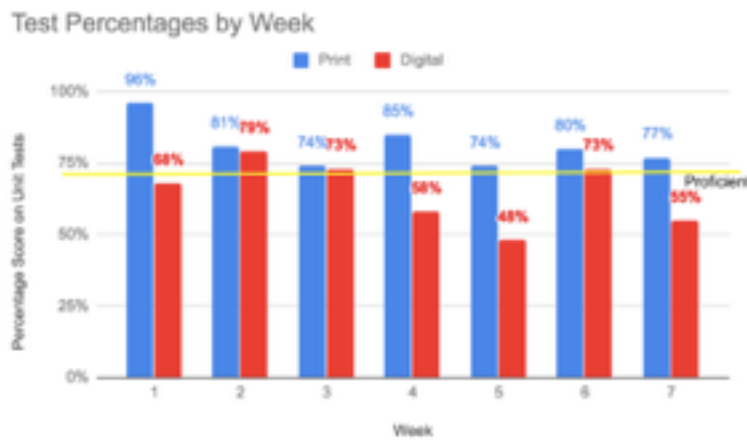


Figure 3. Average scores from text dependent comprehension quizzes per week in both print and digital

Data had also been collected as a whole and shows the overall scores for students receiving print or digital instruction on their weekly assessment scores. The students who received instruction and testing in print from scored, on average, 16 percentage points higher than those who received instruction and testing in digital form. The data is displayed below.

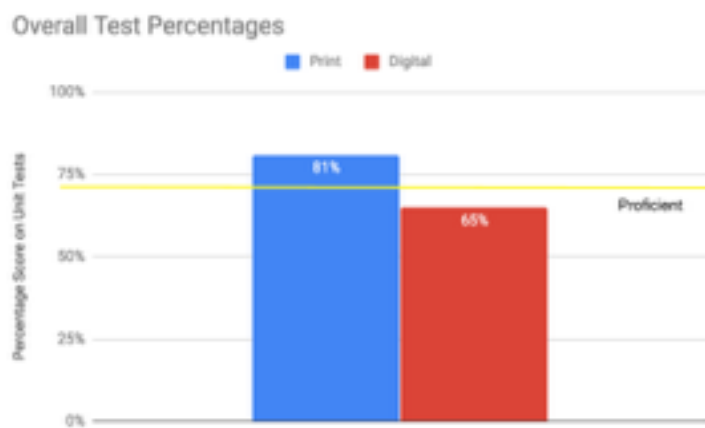
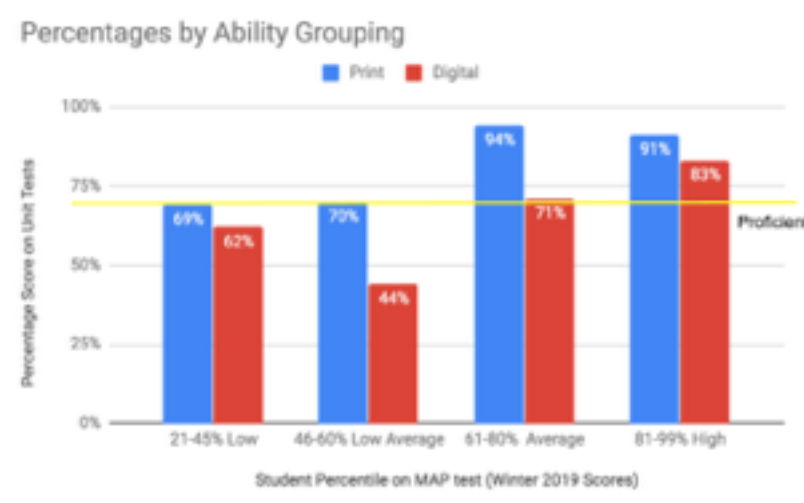


Figure 4. Overall average scores from text dependent question quizzes in both print and digital form.

Data was also collected by ability level. The students were grouped into percentile categories based off of their scores on NWEA MAP testing. Four groups were formed. There were no students that scored below the 21st percentile, therefore the lowest group are those who are in the 21st to 45th percentile. The low average group consists of students who scored in the 46th to 60th percentile. The average group scored in the 61st to 80th percentile, and the highest group scored in the 81st to 99th percentile. Each ability group's scores on the weekly text dependent assessments were analyzed and the data is displayed below. Again, all students who were instructed using print text and testing scored higher on the weekly assessments than those who were instructed and tested digitally.



*Figure 5.* Average scores from text dependent question quizzes in both print and digital form shown in baseline ability grouping.

### Limitations

More research will need to be completed on this topic in order to determine the full relationship between print and digital text and reading comprehension. This study helped conclude that instruction and testing given in either print or digital form does have an impact on reading

comprehension. However, it would be beneficial to complete more research to determine which variable had a greater impact on student learning, the method of teaching or the method of testing.

### **Research Questions**

1. Will a relationship appear between reading comprehension and instruction between digital or print text?

Overall students who were instructed and assessed in print form scored higher on weekly comprehension tests than those who were instructed and assessed in digital form.

2. Do students of different reading ability perform differently using digital or print text?

Students across all academic proficiencies scored higher on weekly comprehension tests when instructed and assessed in print form as compared to those instructed in digital form. The greatest difference between performance was in the low average group. On average, students who were instructed and assessed in print form scored a 70% (or proficient score), and those who were instructed digitally scored an average of 44% on weekly comprehension tests.

### **Conclusion**

The data suggests that instructing and assessing students in print form has a greater affect on reading comprehension than instructing and testing in a digital format, as all students performed better on the same weekly text dependent assessments when given print instruction and tests. More research needs to be done to determine if the method of instruction or testing has a greater effect than the other as for a reading comprehension performance.



## Chapter 5

This study took place in a fourth-grade classroom in a small public elementary school on an Air Force Base in Minot, ND. All 30 fourth-grade students participated in the study, as the potential for student relocation was high.

All students were placed into five reading groups based on baseline scores from NWEA MAP reading test. Each of the groups had six students. Two lower reading ability groups were made (Groups A and B), two higher ability groups (Groups C and D), and one average group (E). Groups A and C received reading instruction and tests solely in digital form. Groups B and D received instruction and tests solely in print form, and Group E received a combination of digital and print for both reading instruction and testing.

The purpose of this study was to determine if there was a relationship between digital and print text and reading comprehension in fourth-grade students. Furthermore, the study researched if there was a connection between student reading ability level and receiving digital or print text instruction.

Following an eight week study where weekly text dependent comprehension quizzes were analyzed, it became clear that all students, regardless of ability, scored higher when given instruction and testing in print form. On average students who were instructed and assessed using print text scored sixteen percentage points higher than their peers who were instructed and assessed in digital format. It is important for educators and other researchers to note the results of this study when planning how to deliver reading instruction and assessments to students.

To further the understanding of this topic, more research should be done to determine if the method of instruction or testing has a greater effect than the other as for a reading

comprehension performance. Researchers may also want to investigate further why students are weaker in the area of digital text. Is it due to a higher rate of distractions, or do students need to be explicitly taught how to use digital text like print text is taught in primary grades?

## Chapter 6

A successful learning environment is created through planning, implementing, and reflection. Teachers who are willing to support and share new ideas with one another through thoughtful collaboration are known to have a positive impact on students. Therefore, it is important as an educator to share ideas, resources, and current practices, while being open to new ideas as well.

This study was completed in a school where Professional Learning Communities (PLC) were currently implemented. The PLC groups meet weekly with like grade bands to discuss specific requirements set forth by the district. As a team, grade levels work together to set goals throughout the year, that will impact student growth. Action plans including different strategies, practices, and strategic interventions are noted. Data is shared giving teachers the opportunity to collaborate, plan, and reflect effectively together.

The results of this study were shared with the fifth-grade team (as there is only one fourth grade class this year) as well as our data strategist. This study was relatable to the other teachers as we are all given the option to instruct reading class with digital and/or print resources. We are also required to give our students standardized tests in digital form. Often times our PLC time is centered around a few students who scored poorly on a digitally based standardized test, and we just don't see the struggle in the classroom. The main topic in these discussions has been how do we change our instruction to help them succeed, or are we missing something in class? The results of this study show how students across all ability levels perform better when instructed and tested in print form. Team members discussed this information, knowing that we do not have the option to give print standardized tests, but how to implement practices in the classroom to boost student's ability when reading in digital form, as we know it's not going to go away.

This data was also shared with the building principal. This research study connected to the researcher's individual growth plan for the school year. Best practices were discussed and data was shared.

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