Will You Read It Now?
The Intentional Instruction of Electronic Textbooks in Secondary Schools

by

Le'Nessa LeNae Clark

A dissertation submitted to the Graduate Faculty of
Auburn University
in partial fulfillment of the
requirements for the Degree of
Doctor of Philosophy

Auburn, Alabama
December 10, 2016

Key Words: e-textbooks, e-textbook features, e-textbook instruction, secondary students, comprehension strategies, e-textbook strategies

Approved by

Victoria Cardullo, Co-chair, Assistant Professor, Curriculum and Teaching
Bruce Murray, Co-chair, Associate Professor, Curriculum and Teaching
Sara Wolf, Associate Professor, Educational Foundations, Leadership, and Technology
David Shannon, Professor, Educational Foundations, Leadership, and Technology

Abstract

E-textbooks have generated attention in education and the expectation to use the technology has become a requirement rather than an option. The purpose of this mixed method explanatory sequential study was to explain the impact that direct instruction on comprehension strategy and e-textbook feature connection had on secondary student comprehension. Twenty-four high school juniors in a physical science course participated in this study and were randomly selected within intact groups to be a part of either the experimental or comparison group. Results demonstrate that there was a significant difference between the experimental group who received direct instruction on strategy and feature connection and the comparison group who only received strategy instruction. To illuminate differences, follow up focus groups were conducted and results indicated that students preferred using the highlighting feature of an e-textbook.

Acknowledgments

God, I am so thankful for who you are and what you have done, and are doing in my life. You put me on this path, and although I have yet to fully understand my heavenly purpose other than to love, I am fearless because I know you walk beside. My joy, peace, and clarity, can only come from you.

For God has not given us a spirit of fear; but of power, and of love, and of a sound mind.

2 Timothy 1:7

At this moment I am filled with aching sorrow about the disparities between men and women in various spaces in life, but in particular the work places. Earning my PhD is not only a personal win, but it is a win I will share with the African-American community and women. I do not consider myself to be political, but I can no longer ignore or stand idly by and watch the injustices that these two groups in particular endure. I am uncertain of what the future holds, but whatever is coming, I will be **ready.**

I will be there to **SPEAK** for the *silenced* and **FIGHT** for *weak*. This is my promise.

Ain't I a Woman……. -Sojourner Truth

Research in education is messy, open for individual interpretation, difficult to transfer and/or generalize and often unreliable, but I tried…..I tried really hard. Thanks to all my PhD buddies in the struggle that understood me and could relate to this hell, you will always be in my heart. Dr. Desmond Woodruff Delk, you allowed me to complain about my research, question my future and life decisions, and threaten to quit my program, but did not allow me to feel sorry for myself too long. You always offered me the “now that’s over, let’s keep it moving and get this money.” Thank you for the tough love. Julia (JT) and Courtney (CF), I’m so happy to call you ladies friends. When I think about my PhD process, some of my funniest moments and most meaningful conversations were spent and had with you! Thank you for always being there for me in any way you could. Thank you for opening your homes and hearts. You are my family.

Dr. A., you have the best heart. Your willingness to assist me even though you were not on my committee was inspiring…words cannot express how thankful I am to know you. To my committee, Dr. Bruce Murray, Dr. Victoria Cardullo, Dr. Dave Shannon, and Dr. Sara Wolf, thank you for all your hard work and dedication during this long tedious process; you have done so much for me.

Dr. Murray thanks for your open door policy. I dropped by quite often and you were always there to listen and help me where you could. Dr. Shannon, thank you for pushing me to make deeper connections in my research. It was tough, but you were there to guide me through this process.

Dr. Wolf, I appreciate your wealth of knowledge, your ability to find information, our goofy (sometimes they were serious) conversations, and your leadership. You challenged me to revisit my practices as an educator and expand my initial assumptions of what I thought effective leadership and instruction looked like. Wherever I land, I will trust my intuition of revisiting and re-evaluating instruction and/or leadership in efforts to avoid becoming complacent.

Dr. Victoria Cardullo (Dr. C./Ipad), you saved me BIG TIME! Before you came into my life and onto my committee, all I knew was that I was interested in secondary comprehension, but you helped me to put the pieces together in efforts to focus my research. Although it was hard, and I certainly bemoaned the dissertation process, your support never wavered. You fed me (you and Mr. Cardullo), you laughed with me, laughed at me, listened to me, rolled your eyes at me, and answered all my random calls, texts and e-mails. You challenged me, educated me, wrote and planned with me, and never forced me to stray from what I thought my plan should be…You are the epitome of an awesome professor.

Ms. Phillips, you are so crucial and critical to my professional and personal journey. I truly love you like a mother. Your guidance, knowledge, and wisdom has been nothing but a blessing. I thank you.

To my very awesome and best #sisterfriends in *"I'm Married, but We Still Cool",* it is difficult to put into words the love I have for y'all. Tammy, Alana, Amre, Kamry, and Tiffany, I stayed afloat because of your encouragement, kind-words, pressure, laughter, and love. As I told you before, your existence is insurmountable. You all are truly a God send.

To my terrific line sisters Drs. Juanita M. Morris and Dorrette Grant, your individual "dopeness" set a standard and all I could do is get in #formation.

Mom and Dad, you guys are the BEST parents! You have always done your very best to help your children. I thank God for both of you and all the life lessons imparted. As I grow older and have different life experiences, I find that I understand both of you better as people and my love for you intensifies. In my immaturity and psycho teenage years, I used to question why God gave me "these parents," but honestly through settled and more mature eyes I realize I would not

be who I am and where am I if I did not have you as parents. So what I should have been saying is thank God for blessing me with these parents….geez I was a total spoiled brat….sorry.

Drea and Jules, I am so very proud to be your big sister. I don't always say it, but I hope that I show both of you how much I love you. I'm very proud of your individual accomplishments. Aim to make a major splash in this world, and don't be afraid to NOT fit it, for your gifts are in heaven and not of this world! Trust your journey because it is not an accident. Remember, anything that I can do, you can do better. Forward my dears!

Damon Clark Jr., you are the epitome of love. You show me how love is patient and kind… Although you could not always understand what I was going through, you tried your best. Your support, love, leadership, kindness, and patience were the best things you offered me during this process.…. (and a little tap on the watch to let me know times a wasting). I thank God for you because you are exactly what I need. You're the freedom of what kept me bound. I am so honored to be your wife, and am excited about our future. You are *everything* my love.

To my sweet granny, Emma Louise Rose….I hope to one day be as smart, kind, and wise as you. I hope I have made you proud. I dedicate this work to you. You are my love song.

Table of Contents

List of Tables

List of Figures

CHAPTER 1: INTRODUCTION

Statement of the Problem

In 2012, the Obama administration, issued a call to action to integrate digital textbooks into all classrooms within five years. It is the goal of the administration that all schools integrate digital textbooks into the curriculum by the year 2017 (Toppo, 2012). The purpose of this integration is two-fold: to assure the affordability of class materials and to foster student learning by providing access to current information. In addition to integrating e-textbooks into the curriculum, the Common Core State Standards (CCSS developed by the National Governors Association Center for Best Practices & Council of Chief State School Officers [NGA & CCSSO], 2010) requires teachers to prepare students for digital assessments. Sykora (2014) noted that Common Core assessments were designed to be taken online, which requires students to be comfortable navigating technology.

As a high school English Language Arts teacher, I had a front row seat in witnessing the reading struggles of secondary education students. Unfortunately, there was little assistance provided to students due to a lack of teacher training in the content area of reading. Because of this inequity, I decided to pursue a PhD in Reading Education to learn skills and strategies during the matriculation process and apply them to the field of secondary education in the capacity of an administrator. When I returned to college as a doctoral student, I knew I was interested in exploring reading comprehension among high school students, but I was far from solidifying a clear research path or driving question to guide my research. As a graduate teaching assistant, I acquired an interest in technology as I worked with pre-service teachers to explore proper integration of technology into their future classrooms.

To alleviate the mounting cost of graduate school, I also started purchasing e-textbooks instead of traditional textbooks that are substantially more expensive and take longer to ship. When I started using e-textbooks, I had to acquaint myself with the different capabilities, features, and functions of the medium. It was a learning curve, but in order to participate in my own classes with students that were using traditional textbooks, it was mandatory to familiarize myself with e-textbooks.

The CCSS details expectations for technology integration into all content area courses. The English Language Arts (ELA) Anchor Standards of the Common Core state that students should be able to "integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally" (NGA & CCSSO, 2010). With the explosion of technology and one-to-one technology initiative implementation in schools, it is imperative that teachers understand how to provide meaningful instruction on how to maximize the use of these tools for the students' benefit.

To date, researchers (e.g. Shepperd et al., 2008; Woody et al., 2010; Jones & Brown, 2011; Dobler, 2015; Rockinson-Szapkiw et al., 2013) have examined the differences in student learning, comprehension, and use between e-textbooks and traditional print textbooks; however, researchers have not examined strategy instruction and feature connection of an e-textbook while reading. Although technology integration in the classroom is new, there is still work to be done in building student comprehension, as the National Assessment of Educational Progress (NAEP) data show a decrease in eighth grade reading scores from 2013 to 2015 (2015). It is vital that teachers are provided meaningful professional development on how to integrate and use technological tools as supplants rather than supplements in order to adequately prepare students to operate in a technologically-driven society.

Purpose of Study

The purpose of this study was to examine the impact of explicit strategy instruction and e-textbook feature connection on student comprehension. Researchers have studied students' learning experiences by examining comprehension growth and affinity towards e-textbooks as opposed to traditional printed textbooks, but they have failed to examine the impact teacher instruction plays on student understanding and usage of e-textbooks.

This study sought to explain how providing direct instruction to teachers on connecting e-textbook features to comprehension strategies improves student comprehension of an informational e-textbook. Collaborating with a secondary science teacher to develop and implement multiple lessons to provide student instruction on specific features (e.g., highlighting, note-taking, and strikeouts) of an e-textbook and how to use those features to accomplish specific reading strategies such as summarization and question generation accomplished this goal. Using Kintsch and Van Dijk's (1978) reduced summarization rules, students learned how to apply e-textbook features to reduce a text to a concise summary. Students received instruction on how to generate notes while reading from an e-textbook to formulate critical thinking questions that would test their comprehension of the text's content. I exposed the students to additional features of the e-textbook such as the searching, defining, and bookmarking capabilities in efforts to provide an easier transition to reading electronically. My hypothesis was that students who were taught how to connect metacognitive strategy instruction to features of the e-textbook would show increased reading comprehension versus the control group which was only provided strategy instruction.

The participants in this study were 24 eleventh-grade students who matriculated in a high school in the southern United States. Three intact classes received either strategy instruction and e-textbook feature connection or only strategy instruction. The criteria to participate in this study were physical possession of a school-administered iPad device with accessibility to a physical science e-textbook. All three classes were team taught by me and the participant teacher. I taught comprehension strategies and e-textbook feature connection. The participant teacher integrated the physical science content and metacognitively modeled strategy choices and e-textbook feature use and connection. One group of students received feature-plus-strategy connection instruction. Two groups of students received the strategy-only treatment. All participating students completed a pre- and post-test to determine growth in content knowledge. Participants also completed two surveys to determine their knowledge of an e-textbook and metacognition while reading from an e-textbook. Finally, students participated in focus-groups to provide me with further information on what the students believed influenced their comprehension while reading from an e-textbook.

Theoretical Framework

In an effort to understand student interaction with e-textbooks and reading strategies, I used several theories to anchor and/or support the research outcomes. Metacognition is an integral component to achieving reading comprehension, but the actual use of metacognition can only be achieved by supporting and/or teaching the use of metacognitive strategies (Magaldi, 2010). This study examined and observed students' metacognition while reading from an e-textbook. To measure student metacognition, students used a survey wherein they reflected on their reading behaviors while reading from an e-textbook.

I used the theory of self-regulation to understand student feature choices and the customization of learning. Metacognition is a component of self-regulation which addresses how a learner understands and controls their learning environment (Schraw, Crippen, & Hartley, 2006).

Finally, applied to this study was the New Literacies theory as e-textbooks qualify as a new information communication technology (ICT). Further, reading from an e-textbook potentially impacts the way learners comprehend text. According to Leu (2000), technological literacy has become an advancer of society and has changed the way we seek and gather information. Further, Leu asserted that technology has affected the way people gain, process, and retain information. As a result, strategies, skills, and dispositions that were once prevalent in education no longer seamlessly fit into what literacy means or how to achieve it.

Metacognition

Metacognition is a key component to reading comprehension. It enables us to be successful learners and has been associated with intelligence (Borkowski, Carr, & Pressley 1987; Sternberg, 1984; Sternberg, 1986a; Sternberg, 1986b). Metacognition, or executive control of learning, is a complex construct that is still actively studied and researched today. Flavell (1976, p. 232), who first coined and introduced the term “metacognition” into education, defines it as the following:

> Metacognition refers to one’s knowledge concerning one’s own cognitive processes and products or anything related to them…the active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects on which they bear, usually in the service of some concrete goals or objectives (p. 232).

Stemming from Flavell's seminal work (1976), various researchers have sought to provide clarity and understanding of metacognition and all its components. Hacker (1998) detailed metacognition as including knowledge of one's own cognitive and affective processes, as well as the ability to monitor and regulate those states. Schraw and Dennison (1994) explained metacognition as "the knowledge and awareness of one's own cognitive process and the ability to regulate, evaluate, and monitor one's thinking" (p. 46). Livingston (1997) defined metacognition as "higher order thinking which involves active control over the cognitive processes engaged in learning" (p. 1). Finally, Griffith, and Ruan (2005) defined metacognition as awareness and judgement about an event gained through experience. Largely, there is a consensus among researchers that metacognition refers to the "knowledge about cognitive states and abilities that can be shared among individuals while at the same time expanding the construct to include affective and motivational characteristics of thinking" (Paris & Winograd, 1990, p.15).

Within the body of literature on metacognition researchers (e.g., Schmitt & Newby, Livingston, Schraw & Moshman, Brown & Baker, & Jaccobs & Paris) hone in on the phenomena of knowledge and regulation of cognition. Schmitt and Newby (1986) defined knowledge as one's awareness of cognitive resources in relation to a task. Livingston (1997) provided a three-fold perspective of metacognitive knowledge, stating that knowledge comes in the form of person, task, and strategy variables. Person variable knowledge is the "general knowledge about how human beings learn and process information" (Livingston, 1997, p .1). Task variable is knowledge about the "nature of the task and the type of processing demands that it will place on the individual" (Livingston, 1997, p. 1), and strategy variable is "knowledge about both cognitive and metacognitive strategies, as well as conditional knowledge about when and where to use such strategies" (Livingston, 1997, p. 2). Brown (1987) and Baker (1991) also made the distinction between knowledge of cognition and regulation of cognition. Schraw and Moshman (1995) defined knowledge of cognition as knowledge about one's own cognition or cognition in general. Jacobs and Paris (1987) identified three types of metacognitive awareness that can stem from knowledge of cognition. Declarative knowledge is knowledge about oneself as a learner. Procedural knowledge refers to knowledge on the execution of procedural skills. Finally, conditional knowledge is understanding and knowing when and why to apply cognitive knowledge in a given situation (Jacobs & Paris, 1987).

The second phenomenon of metacognition is the regulation of cognition. Schmitt and Newby (1986) argued that in order to regulate cognition, one has to plan, monitor, and revise in order to repair a breakdown in comprehension. Schraw and Moshman (1995) added that in order to regulate one's cognition, one must employ metacognitive strategies in order to assist in controlling one's own thinking and learning. While regulating one's cognition, one must establish automatic skills which are planning, monitoring, and evaluating (Jacobs & Paris, 1987). In simpler terms, these skills are described as "planning one's next move, monitoring the effectiveness of any attempted action, and testing, revising and evaluating one's strategies for learning" (Baker & A. L. Brown, 1984, p. 354). Taking a closer look, Schraw and Moshan (1995) described the skill of planning as a learner's ability to select appropriate strategies in order to impact performance. Once the strategies are selected, it is then up to the learner to determine if the selected strategies are working in the context of the learning activity. This can be done by self-testing or self-questioning (Eker, 2014; Schmitt, 1986; Schraw & Moshman, 1995). The final skill in regulating cognition is evaluation/regulation. Once the learner has chosen a strategy (planning), and checked the strategy for its effectiveness (monitoring), he or she should next evaluate or re-evaluate the goal for learning. Zimmerman (2000) noted that learners who have acquired metacognitive strategies should evaluate themselves at the end of the process.

Connection to Study

When students are working to comprehend material in the physical science e-textbook metacognition is at work. Although this is a behavior that is difficult to observe, traces of the metacognitive process can be found while witnessing the students make decisions about features that potentially aid in their comprehension process while reading from an e-textbook.

Self-Regulated Learning

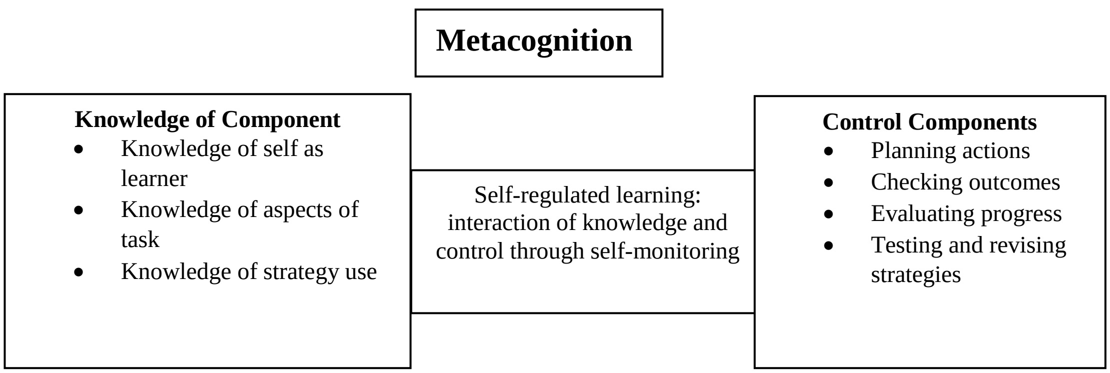
Metacognition cannot be discussed without regulation; however, experts have noted (Pintrich, Wolters & Baxters, 2000) there is confusion about metacognition and self-regulated learning as constructs. Furthermore, there is little distinction between self-regulation and self-regulated learning (Massey, 2009, p. 389). Zimmerman (2000) defined self-regulated learning as "self-generated thoughts, feelings and actions that are planned and cyclically adapted to the attainment of a personal goal" (p. 14). Pintrich, Wolters and Baxter (2000, p. 4) expanded self-regulated learning to include "monitoring, controlling, and regulating cognition and monitoring, controlling and regulating other factors that can influence learning such as motivation, volition, effort and the self-system." Arslan (2006) described metacognition as a skill to understand and monitor the metacognitive process.

Metacognition and self-regulated learning are often grouped together, but it is important to distinguish that these concepts do not perform the same tasks. Massey (2009) noted theories of self-regulation are often combined with "theories of motivation, theories of metacognition and theories of learning" (p. 391). Self-regulation is most often situated as a subset of metacognition

(Baker, 2002; Griffith & Ruan, 2005). In order to regulate the constructs that make up metacognition (knowledge and control), one must self-regulate and self-monitor their interaction. Massey (2009) offered a visual representation of metacognition and how self-regulated learning connects metacognitive knowledge and control (p. 391).

Figure 1

The Connection of Metacognition and Self-Regulation (Massey, 2009)



Massey's visual representation of metacognition connects to Zimmerman's (1990) general components of metacognition and self-regulated learning, which include metacognitive knowledge, judgements, and monitoring, as well as self-regulation and control. Massey's visual representation of metacognition (see Figure 1) suggests that although metacognition and self-regulated learning are separate theories, they still work together.

Connection to Study

Self-regulation is a component of metacognition. A part of being metacognitive is a reader's ability to regulate their learning while reading from text. In this study, after students received instruction about how to apply metacognitive strategies while reading from an e-textbook, each student had to regulate his/her learning once the intervention was complete. Selecting specific strategies or e-textbook features shows self-regulation on the part of the student as these strategies or features are used to either repair or monitor comprehension.

New Literacies Theory

Since the proliferation of e-readers, Kindles, iPads, and other digital reading platforms, the activity of reading and literacy has become deictic. This means that literacy is rapidly changing because of new information and communication technologies (Leu, 1997, 2000). Literacy, once a stagnant concept, now depends on how the reader adapts to present and future platforms for accessing information.

Changes in what it means to be literate have prompted researchers to develop theories in efforts to explain what these changes mean for reading and its field of study. On the forefront of documenting and explaining these changes, researchers (e.g., Castek, 2008; Coiro, 2003; Henry, 2006; International Reading Association, 2009; Lankshear & Knobel, 2006; Leu et al. 2013; New London Group,1996) have developed and studied the theory of New Literacies in efforts to account for the rapid changes in literacy. This theory is complex as there are multiple points of view on the changes that are taking place in literacy. Street (2003) claimed that new literacies capture new social practices of literacy. Other researchers and literacy organizations (Castek, 2008; Coiro, 2003; Henry, 2006; International Reading Association, 2009) view new literacies as a way to study emerging skills, strategies, and dispositions that are essential for online research and comprehension. Researchers (Kress, 2003; Lemke, 2002) also viewed new literacies as a new discourses or semiotic context. Regardless of the different perspectives in new literacies, either cognitive and language processes or social practices, the literacy community agrees on the need to make adjustments in literacy to adapt to new and emerging technologies.

To account for and attempt to explain the changes in literacy, the theory of new literacies has become dual: lowercase (New literacies) and uppercase (New Literacies). For the purposes of this study, special attention was paid to the (uppercase) New Literacy theory. In efforts to illuminate the ideas and perspectives of New Literacies, Leu et al. (2013) outlined eight central principals:

> 1) The Internet is the generation's defining technology for literacy and learning within our global community. 2) The Internet and related technologies require additional new literacies to fully access their potential. 3) New Literacies are deictic 4) New Literacies are multiple, multimodal, and multifaceted. 5) Critical literacies are central to new literacies. 6) New forms of strategic knowledge are required with new literacies. 7) New social practices are a central element of new literacies. 8) Teachers become more important, though their role changes, with new literacy classrooms. (p. 1158)

For the purposes of this research, new literacies remains defined as skills, strategies, and dispositions necessary to successfully use and adapt to the rapidly changing information and communication technologies (ICT) and context that continuously emerge and influence all areas of personal and professional life as student participants in this study are implementing strategies taught by the researcher while reading from an e-textbook. New Literacies allow people to use the Internet and other ICTs to identify important questions, locate information, critically evaluate the usefulness of that information, synthesize information to answer those questions, and then communicate the answer to others. Reading from an e-textbook does not necessarily qualify as online reading; however, it does classify as an ICT that modern students are navigating and employing new strategies in order to obtain literacy. In addition, depending on the type of e-textbook, students may find themselves navigating online reading from active links provided within an e-textbook.

Leu et al. (2013) detailed eight central principals to further explain the New Literacy theory. Although eight principals are identified, this study focused on four principles of New Literacies theory to frame the researchers' investigation on e-textbooks and secondary comprehension.

Leu et al. (2013) first principle states "the Internet and related technologies require additional new literacies to fully access their potential*" (p. 1159)*. This principle noted that foundational literacies needed to be expanded and possibly connected to emerging new literacies skills, strategies and dispositions in efforts to understand new technologies. Leu et al. (2013) described foundational literacies as skills or strategies used with traditional text reading and writing. These strategies could include, but are not limited to word recognition, vocabulary, comprehension or inferential reasoning. The researchers argued that foundational skills could cross-over to ICTs or online reading experiences, but they needed to be re-worked to fit the new reading experience. Furthermore, Leu et al. (2013) cautioned that these foundational literacies could not be sustained individually while using the Internet or other ICTs. Thus, there is a need for connectedness of foundational literacies and new literacies.

The next principal described New Literacies as deictic. Leu et al. use the term deictic to describe the rapid changes occurring in literacy because of new technologies (2004; 2013). While explaining the need for New Literacies, Leu et al. (2004) asserted that there was a time when the development of new technologies moved at a slow pace; however, this does not reflect modern times with new versions and upgrades of different technologies available more often, and New Literacies attempts to keep up with the changing technologies and how they impact literacy. Leu et al. (2013) postulated two sources for the deictic changes in literacy. The first source projected the development of new technologies transforms previous literacies, which impacts what it means to become literate (Leu et al., 2013). The second source suggested that we recreate or reconstruct new social practices when new technologies emerge. This means that our ideas on what it means to be literate and how we interact socially change with the development of new technologies. Leu et al. (2013) cautioned “the already rapid pace of change in the forms and functions of literacy is exacerbated by the speed with which new technologies and new social practices are communicated” (p. 1160). Therefore, it is crucial for researchers, practitioners, and developers of technology to collaborate on what it means to be literate while using new technologies, in efforts to provide a clearer understanding to the consumer of these technologies.

The third principal declared new forms of strategic knowledge are required with new literacies. With the emergence of new technologies comes the necessity to devise new skills and strategies for learners to achieve literacy. Devices come equipped with multiple functions, features, and capabilities that the reader has to navigate in efforts to become literate. Lawless, Mills, and Brown (2002) suggested that features like hypertext and embedded forms of media can distract the reader from important information, and because of this it is important to be proactive in developing new strategies to support readers when using new forms of technology. The principle of New literacies also encompasses the different types of strategies that are emerging or need to be developed in order to become literate.

The final principle used in this study states teachers become more important, though their role changes, within new literacy classrooms. There is an assumption that students typically know more about ICTs and online activity than their teachers; thus, it has become necessary for the teacher to be collaborative with his/her students. Leu et al. (2013) suggested that teacher and student collaboration on new literacies may lead to an enhancement of literacy skills. There will always be a need for teacher facilitation; however, the outlook and perspective on what it means to be a teacher or teach in a new literacy classroom is evolving. Leu et al. suggested that instead of dispensing literacy skills, teachers will rather orchestrate learning contexts (2013). This means that teachers will be responsible to guide student learning through multiple types of digital media; thus, an emphasis should be placed on technology integration in all teacher training programs and professional development for teacher to continue education.

Connection to Study

With the implementation of e-textbooks in the classroom and the demands that CCSS has placed on students to demonstrate a "command of technology" (Avila & Moore, 2012), it has become essential that researchers understand how technology impacts literacy, and to understand the impact e-textbook have on student literacy it is imperative to position New Literacies as a framework. New Literacies sought to understand not only how new technology impacts student learning experiences, but also explore strategies, skills or dispositions that are needed to facilitate learning with new technologies. In this study students used an e-textbook which qualifies as a New Literacy but the missing component or what is unclear is what strategies are aiding in comprehending content read from an e-textbook, which is also a component of new literacies. Furthermore, this study illuminated the teacher's role in facilitating learning when using an e-textbook.

Research Questions

This study examined and investigated the primary research question: How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension? To illuminate and understand what specifically impacted student comprehension when reading from an e-textbook, I developed two sub-questions. The sub-questions are the following:

a. How are students metacognitively using features of the e-textbook?

b. What features of the e-textbook support comprehension?

A variable is a characteristic or attribute of an individual or an organization that can be measured or observed and that varies among the people or organization being studied (Creswell, 2009, p. 50). Presented in this study were the following variables:

Variables

1. *Independent variable:* The presence of strategy instruction in all groups.
2. *Dependent variables:* Student comprehension and metacognition in all groups.

Definition of Terms

Direct instruction: An approach to teaching. It is skills-oriented, and the teaching necessitates teacher-directed instructional practices. It emphasizes the use of small-group, face-to-face instruction by teachers using carefully-articulated lessons in which cognitive skills are broken down into small units, sequenced deliberately, and taught explicitly (Carine, 2000).

Electronic textbook (e-textbook): A book-length publication in digital form, consisting of text, images, or both, readable on computers or other electronic devices.

Information communication technologies (ICTs): "An umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning" (Rouse, 2005 para., 1).

Informational text: A text whose primary purpose is to convey information about the natural and social world (Duke & Bennett-Armistead, 2003). The elements of an informational text may include the following five elements: the author's purpose, major ideas, supporting details, aids and vocabulary. The structure of informational texts typically includes enumeration, time order, compare and contrast, cause and effect and question answer (Marinak & Gambrell, 2009).

Metacognition theory: The knowledge of one's cognitive and affective processes as well as the ability to consciously and deliberatively monitor and regulate those processes (Hacker, 1998).

Self-regulated learning: A person's ability to understand and control his or her learning environments (Schraw, Crippen, & Hartley, 2006).

New Literacies theory (upper): Broader more inclusive concept that includes those common finding emerging across multiple, lowercase theories. New social practices emerged from new technologies that have an impact on literacy (Leu et al.2004; Leu et al.2013)

New literacies theory (lower): Explores specific areas of new literacies and/or technologies; new skills, strategies, dispositions, and social practices that are required by technologies for information and communication (Leu et al.2013).

Reading comprehension: An active and complex process that involves understanding of written text, developing and interpreting meaning, and using meaning as appropriate to type of text, purpose, and situation (NAEP, 2009).

Reading comprehension strategies: Conscious and flexible plans that readers apply and adopt to a variety of texts and tasks (Pearson et al.1992).

Limitations

I made multiple attempt to prevent limitations that appeared in this study; however, the following limitations were present:

1. Time with materials
    a. Teacher: The study was a total of eleven weeks—two weeks of teacher training, two weeks of instruction, and seven weeks of collecting data. Ultimately, the participant teacher did not feel comfortable teaching the reading strategies or features connections. In efforts to ensure delivery of the treatments, I became a participant observer by providing pivotal instruction to treatment groups.
    b. Student: I taught strategies using a layering effect. Therefore, students had only one week between treatments to show use or mastery of each reading strategy and/or reading strategy and feature connection.
2. Materials: Although students were required to bring their iPad to class with them daily, some participants failed to abide by this standard, thus missing key practice time with group specific treatments.
3. Building infrastructure: Although some students had the appropriate materials, their iPads were often dead. Unfortunately, the room was only equipped with six electrical sockets, which allows for only twelve potential outlets for charging. However, the grouping of the desks did not allow students to reach sockets without discomfort or disruption to the classroom setting.
4. Sample size: The total number of participating students was 24. Multiple efforts were made to recruit student participants; however, the participant criteria of this study prevented many students from participating, as they no longer had physical possession of the technology due to various circumstances.
5. Attendance: Students were occasionally absent from class. Two students were suspended, one student was expelled, and one student suffered from a chronic illness and was

frequently absent. These students may have missed pertinent information pertaining to their treatment group and practice time.

6. Participant observer: The researcher and teacher team taught the treatments to both groups.
7. Instruction delivery: Prior to the study, students were accustomed to completing an assigned content literacy guide for credit. The content literacy guide featured fill-in-the-blank questions and was developed by the teacher participant. For the study, the teacher was asked to cease the implementation of the content literacy guides and to instead task students with developing their own notes and questions while reading from an e-textbook.

Organization of Remaining Chapters

A detailed description of this study is organized into five chapters. Chapter 1 explains the trajectory of the integration of e-textbooks into American classrooms. It also provides a brief rationale for the examination of reading strategy instruction and e-textbook features by discussing the problem, purpose, and background of the study. Chapter 1 also provides essential research questions that guide the study, a brief synopsis of the research design, unavoidable limitations that arose during the duration of the study, and definitions of key terms. Chapter 2 provides a detailed description and synthesis of existing literature pertaining to the study. This includes a description of research that was conducted in the following areas: e-textbooks, new literacies, self-regulation, metacognition, and reading comprehension strategies. Chapter 3 provides a detailed description of the methods and procedures used in this study. This includes a detailed description of the setting, participants, materials, variables, research design, and procedures. Chapter 4 describes the analysis of the quantitative and qualitative data collected for this study. This includes scores on the pre- and post-content exams, *i*-MARSI survey results, e-textbook surveys, codes and themes derived from observations and field notes, and interviews from the study. Finally, chapter 5 discusses the results as they pertain to the guiding research questions for this study. This chapter also expands upon the implications of the study's limitations, as well as areas that necessitate future research.

Chapter 2: Review of Literature

In 2012, the Obama Administration asked that all schools accelerate the transition to digital textbooks (Toppo, 2012) with the goal of using only digital textbooks in classrooms by 2017. The administration argued that by switching to digital textbooks, teachers will have access to current and real-time information, educational costs for textbooks would decrease, and students would become more efficient learners. Researchers have conducted few studies to understand the impact of reading from an electronic textbook (e-textbook), and because of this shortfall, it is still unclear if reading from an e-textbook will affect student comprehension.

Without comprehension or understanding of text, reading is impossible. In early childhood and elementary school, students acquire the basic foundations of reading, including phonemic awareness, phonics and the ability to decode. Gough and Tunmer's (1986) suggested reading comprehension is an outcome of the development in two basic areas: decoding skills and language comprehension. However, what happens when students who do not obtain grade-level appropriate skills are promoted to the next grade level? To further complicate this matter, Gough and Tunmer's Simple View of Reading evolved into more of a complex view, as researchers have identified other skills (such as metacognition, comprehension monitoring, and the use of comprehension strategies) that are necessary to become a successful reader.

Rather than simply reading and comprehending text from traditional textbooks, students are now asked to know how read from diverse multi-media formats, analyze online information, and to operate an e-textbook for the purposes of comprehension. In addition to the possibility of transitioning to using e-textbooks exclusively by 2017, school districts are already adopting one-to-one laptop or iPad initiatives, which give every student within the district access to technology to either a laptop or an iPad (Coiro, 2016). Now there is an added layer for teachers to integrate technology into the curriculum. Schugar, Smith and Schugar (2013) noted although teachers believe it is important to integrate information and communication technologies (ICTs) into the classroom practice, "their implementation lags behind their beliefs" (p. 617). Although teachers may be uncomfortable or lack sufficient knowledge on how to integrate technologies into their classroom practice, it is still important to provide explicit instruction on how to read and transfer traditional reading strategies to assist in reading from an electronic platform.

State of Adolescent Literacy

The field of education is constantly changing, but some argue that it is not changing fast enough. Educational initiatives shifted from "No Child Left Behind" which was a response to a concern that American students were no longer able to compete internationally; therefore, the attention was refocused on Reading and Math content areas to Common Core State Standards (CCSS), which now guides teachers to provide rigorous instruction in Math and English (Klien, 2015). CCSS standards were developed in order to prepare students to compete globally (NGA & CCSSO, 2010) and to provide proper preparation for students to thrive and compete after graduating from high school for either college or immediate transition into the work force. To comply to CCSS, standards, students are expected to be exposed to a 50-50 balance of literary and informational reading in kindergarten through fifth grade and receive a substantial increase of literary non-fiction text in sixth through twelfth grade (NGA & CCSSO, 2010). With the increase of informational text in all grade levels, there seems to be confusion about what qualifies as an informational text (Maloch & Bomer, 2013). Duke defined informational text as "text written with the primary purpose of conveying information about the natural and social world (typically from someone presumed to be more knowledgeable on the subject to someone presumed to be less so) and having particular text features to accomplish this purpose" (2000a, p.

205). Common Core identifies four types of informational text that students should be exposed to during the matriculation process: literary nonfiction, expository, argument or persuasion, and procedural (NGA & CCSSO, 2010). Young and Ward (2012) gave detailed descriptions and examples of each type of prescribed text. They are as follows:

> Literacy nonfiction is a short text that includes personal essays, speeches, opinion pieces, essays about art of literature, biographies, memoirs, journalism, and historical, scientific, technical, or economic accounts (including digital sources) written for a broad audience. Expository texts contain tables of contents, indexes, or other navigational devices so that readers may read only the portions of the books that interest them, making it unnecessary to read the books cover to cover. Argument texts provide evidence with the intent of influencing the beliefs or actions of the target audience. These texts typically include claims, evidence, and warrants to explain how the evidence is linked to the claims. Procedural text provides step-by-step guidelines that describe how to complete a task. (para, 6, 10, 12-14)

For the purposes of this research special attention will be paid to expository text, as students seem to struggle with the complexities of this format due to additional skills needed to comprehend this style of text. Expository texts require students to make inferences, solve problems, reason, and use complex and varied text structures that differ when reading from a narrative text (Snow, 2002). Expository text can be consumed in increments and does not need to be read in a systematic order. Expository text typically uses genre-specific structures, such as description, cause and effect, comparison and contrast, problem solution, question and answer, and temporal sequence (Young & Ward, 2012). Many secondary students struggle to read complex expository text, such as science textbooks (Roberts et al.2012). In addition to lacking background knowledge in the content of science, there are compounded issues such as unfamiliar multisyllabic words, unfamiliar facts, and lack of knowledge both academic language and vocabulary (Carnine & Carnine, 2004; Oliver, 2009) that interfere with student understanding. As a part of comprehension, readers need to be familiar with vocabulary presented within a text, and unfortunately, this is not always the case.

The Common Core State Standards created a staircase of increasing text complexity, so that students are expected to both develop their skills and apply them to more and more complex texts (CCSS, 2010). Although the CCSS increased the rigor and demands of the type of reading students are doing, the NAEP report card suggests students in secondary education still struggle with reading. The NAEP report card reveals that eighth-grade students' reading scores decreased in 2015 from 2013 by two points (NAEP, 2015). With the release of the NAEP reading data and the implementation of CCSS, there is still a concern with the state of adolescent literacy.

Since technologies, devices, and applications are constantly changing, the ways we access information similarly evolved (Leu, Kinzer, Coiro, Castek, & Henry, 2013). These subtle changes to the way we obtain information impact the way we seek, retain, and gain information. With the development of new technologies and applications, adolescents are expected to understand and use print and nonprint resources across the disciplines (ILA, 2012). Moje (2008) argued texts have become increasingly complex, multimodal, and necessary for discipline-specific learning and middle and high-school students must adapt by using more advanced, specific strategies for deeper understanding and composing. Many schools have replaced traditional textbooks with e-textbooks that are accessed using e-readers, tablets, or laptops (ILA position statement, 2012). Researchers have pointed out advantages to transitioning from traditional to e-textbooks (i.e., cheaper cost, quicker availability of new information, easier transportability, and differentiated instruction) (Kim & Jung, 2010). Exposing students to technology such as e-textbooks can prepare them to become productive citizens in the 21st century (ILA, 2012).

Defining E-Textbooks

Electronic textbooks are defined in various ways throughout the literature; some studies have referred to them as electronic books (e-books), digital books, and of course, electronic textbooks (e-textbooks). Chesser (2011) noted that there still uncertainties about what qualifies as an e-textbook. There are differing opinions on the usage, design and purpose for reading an e-book. Although, an e-book was not used in this research, it was still important to compare and contrast the differences and similarities of each style to book. Grudizen and Casey (2008) stated e-books are print books that have been completely converted to or originated in a digital format. Daniel and Woody (2013) offered that e-books are used for personal goals and pleasure reading, while e-textbook readers have the additional goal of learning or memorizing portions of the text. Rockinson-Szapkiw et al. (2012) determined that e-textbooks are digital and accessed through computer screens or mobile devices. Lee, Mossom, and Kok-Lim (2013) offered that e-textbooks are digitized forms of textbooks which need endorsements by the national or state government when used in compulsory public education systems. What remains consistent about digital textbooks is the exchange of information to the reader based on interaction with the digital platform.

Although there is a lack of consistency within the body of literature, it is vital to note that there are significant distinctions between these types of electronic texts. Researchers group electronic texts into four categories (enhanced e-textbook, basic e-textbook, e-book, and digital textbook), and two styles of formats (page fidelity and reflowable). Upon closer inspection of the different styles and formats of e-textbooks, there are similarities.

Walling (2014) identified a basic e-textbook as an electronic version of a printed textbook. Chesser (2011) identified two types of formats for electronic textbooks: page fidelity and reflowable. Like basic e-textbooks, page fidelity e-textbooks are scanned pictures of the print version of the book. An example of this is a PDF file with no dynamic media, inactive web links, and no capability to manipulate (e.g., pinch, to increase, or decrease) font or pictures.

An enhanced e-textbook presents content with various types of media (e.g., print, video, podcast, hyperlinks) and could include social networking capabilities. These features allow the reader to tailor his or her learning. Furthermore, enhanced e-textbooks can be originally created to be consumed digitally (Dobler, 2015). Like enhanced e-textbooks, reflowable e-textbooks use a flexible system that includes dynamic media and allows the user to modify the layout and interact with features of the e-textbook (Chesser, 2011), These are unlike page fidelity e-textbooks, which are typically cumbersome and are often unavailable or difficult to manipulate on handheld devices (Rockinson-Szapkiw et al., 2013).

Like enhanced or reflowable e-textbooks, digital textbooks are equipped with features that offer various interactive functions, online dictionaries, and multi-media content (Byun, Choi, & Song, 2006). "Digital textbooks are alive and in motion; as such, they are literally living and moving textbooks that construct and create knowledge not only for individual learners, but also for the community as well as support and help manage teaching activities," (Kim & Jung, 2010, p. 248). Unlike the aforementioned e-textbook, e-books are not equivalent products. While e-books feature multimodal tools such written text or oral narration, music, sound effects, a dictionary, a thesaurus, hotspots, and animation capabilities for its readers (Korat, 2009; Schugar et. al. 2013), they are typically read for personal goals and enjoyment. In contrast, when reading from an e-textbook, the user has a specific goal of learning and memorizing portions of the texts (Daniel & Woody, 2013; Grudzien & Casey, 2008). A feature analysis was used to visually display and analyze the similarities and differences of the types of e-textbooks discussed in this section. The style and format of an e-textbook presented in figure two is categorized as a class, and a defining feature of an e-textbook is represented in each of the six columns. I analyzed the features of each style of e-textbook against the feature represented in each column, and either marked plus (+) to indicate that the particular class has the feature. A zero (0) indicates that the class does not have that particular feature, and sometimes (S) indicates that the class may sometimes have the particular feature.

Figure 2

Feature Analysis of E-textbook Capabilities

Class: e-textbooks	Multi-modal	Customizable features	Interactive features	Social networking	Accessible and compatible on various technology devices	Static
Enhanced	+	+	+	+	+	0
Basic	0	S	0	0	0	+
Reflowable	+	+	+	+	+	0
Page-fidelity	S	S	0	0	S	+

Note: A plus indicates the tool has the feature; a zero indicates it does not; s indicates it sometimes has the feature.

The e-textbook used in this study qualified as Dobler's (2015) basic e-textbook, and the format presented in the e-textbook aligned with Chesser's (2011) print/page fidelity format. The Glencoe-produced Physical Science e-textbook is a PDF version of the traditional printed text. For this study, students read from an application called "Documents" by Readdle. Launched in

2013, this app was made to make viewing PDF, Office, images, videos, and music documents from an iPad simpler. Documents comes equipped with features such as an online dictionary, highlighting, note-taking, copy and paste, and bookmarking to make the process of reading engaging.

Secondary struggling readers

There is a perception that the foundational skills of reading are acquired during the elementary education matriculation process; however, the progression of reading is something that should be reinforced and guided until the completion of the readers' educational journey. Reading instruction for older students with reading difficulties is a topic increasingly in need of well-informed support and research-based guidance (Deshler, 2005; Dole et al. 1996; Scammacca et al. 2007). Although adolescent readers have garnered some attention in the reading research arena, there are still some missing links. The NRP (2000) gained massive attention throughout the educational community, but it was predominantly focused on younger readers, and did not illuminate the different needs of adolescent readers (Ukrainetz, 2015). Since the NRP research has since expanded to include adolescent readers; however, studies that explore digital reading and comprehension strategies has not received much attention with high school students as the population. Since research lacked in the exploration of comprehension strategies with high school students, it was necessary to expand the population to include studies completed in elementary and middle education.

Comprehension Instruction

In 1979, Delores Durkin made a startling discovery about the lack of comprehension instruction occurring in the classroom. Her research uncovered that rather than providing explicit instruction on what, why, how, and when comprehension skills should be used, teachers were, instead, “mentioning” the skill to students. After “mentioning” the skill, teachers expected students to practice and then be assessed on the application of that skill (Pearson & Dole, 1988). Once Durkin called attention to this educational misstep, researchers and practitioners began to pay closer attention to providing explicit instruction on teaching comprehension. Pearson and Dole (1978) noted after Durkin’s research, there was an explosion of studies focused on explicit approaches to teaching comprehension. Within the body of literature about explicit approaches to teaching reading comprehension, “some of these explicit approaches have been labeled direct instruction approaches because they contain some or all of the elements of direct instruction” (Pearson & Dole, 1987, p. 3). Carnine et al. (2004) offered that direction instruction is an approach to teaching instead of a program. The researchers defined direct instruction in the following way (p. 11):

> It is skills-oriented, and the teaching practices it implies are teacher-directed. It emphasizes the use of small-group, face-to-face instruction by teachers and aides using carefully articulated lessons in which cognitive skills are broken down into small units, sequenced deliberately, and taught explicitly.

Gersten and Carnine (1986) postulated in order for reading comprehension to be taught, one must explain the steps taken to achieve it. In the case of a teacher, this is typically done by engaging in a “think-aloud” where the teacher is modeling each step in his or her process to attain comprehension. Low-performing students reap the benefits of direct instruction, as they are provided with an auditory and visual walk-through of their teacher’s thinking process. Students that are exposed to the think-aloud can then mimic the steps in order yield similar results (Gersten & Carnine, 1986).

In many cases, Direct Instruction (DI) is a teaching method that is used to provide cognitive strategy instruction. Pressley (2006) explained that cognitive strategies as constructive interactions with texts, both written and digital, in which good readers and writers continuously create meaning. Dole et al. (2009) described “cognitive strategies as a mental routine or procedure to accomplish a cognitive goal” (p. 348). Cognitive strategies are different than metacognitive strategies, as the latter are used monitor and assess ongoing performance in accomplishing a cognitive task (Dole et al. 2009). Interest in cognitive strategy instruction in science has blossomed since the science literacy concern emerged in the mid-1990s. The concern for literacy in the sciences is associated in part with reading difficult texts—specifically, textbooks (Dole et al. 2009). In order to improve student achievement, CCSS require science teachers incorporate literacy into the content because many because many students are unprepared to comprehend scientific texts and also lack the appropriate strategies to fix a breakdown in comprehension (Craig & Yore, 1995; Kinninburgh & Shaw, 2009).

Spence, Yore and Williams (1995), delivered explicit strategy instruction to a seventh-grade science class. Strategies included text structure, accessing prior knowledge, setting a purpose for reading, monitoring comprehension, using context to interpret the meaning of difficult vocabulary, identifying main ideas, and summarizing. Metacognitive awareness was promoted via dialogue about strategies. In comparison to pre-test scores, students that received instruction showed an improvement in metacognitive awareness, self-management, and reading comprehension in post-tests.

Knowledge of metacognitive strategies cannot exist without the use of metacognition (Magaldi, 2010); therefore, metacognition plays a key role in reading comprehension. Researchers suggested reading comprehension improves if students receive instruction on metacognitive strategies (Cubukcu, 2008; Mokhtari & Reichard, 2002). Although metacognition is a construct that has yet to be examined while reading from an e-textbook, other studies have attended to the construct by generally looking at comprehension gains while reading from a textbook.

Grimshaw et al. (2007) investigated 132 students' comprehension and enjoyment of storybooks based on multiple modes of medium, print and electronic. Participants (ages seven and eight) read to two different stories that were presented to them in either electronic or printed versions. Half the students that read The Magician of Caprona read the story in an electronic format with access to the online dictionary, and the other half read from story from a hard copy format with access to a hard copy dictionary. Two out of three groups of students that read The Little Prince read from an electronic format; however, one group used the narration feature while reading, while the other group did not have access to this additional feature. Finally, the third group that read The Little Prince read the printed versions without access to the dictionary. It is important to note that the researcher did not mention any type of direct instruction provided to students on how to operate and explore specific features highlighted in this experiment, such as narration; however, it was emphasized that the schools whom participated in the study allocated time to develop student information technology skills. Results from the study indicated that comprehension scores were higher for retrieval questions than for inferences, which connects back to narrative format of texts being easier to comprehend than expository text, as the student must be able to make inferences based on the information provided.

Wright, Fugett, and Caputa (2011) determined that comprehension of written materials remained unchanged for students regardless of print or digital. These researchers compared vocabulary understanding and reading comprehension scores from the electronic story book and the printed book. The researchers also evaluated the use of available resources (dictionary, thesaurus, word pronunciation, etc.) between electronic and print platforms. The population tested in this AB experiment was elementary education students. Although comprehension was equivalent in reading from a digital and print platform, data supported that students used reading resources while reading from digital texts in comparison to print. What remains unclear in this study is whether or not the teacher or researcher provided instruction on how to operate electronic texts resources, since there was an emphasis on student interaction with the available digital resources.

Rockinson-Szapkiw et al. (2013) worked with 538 university students to examine the difference in cognitive learning while reading from an electronic or print textbook. Their results indicated that there was no difference in cognitive learning between reading from an electronic textbook and a traditional textbook. Additional questions explored in this study centered around the participants perceived learning from the particular reading platform (i.e. digital or print), and study behaviors related to the type of reading platform. Results indicated that students that used e-textbooks had higher perceived affective learning and psychomotor learning than students who read from traditional textbooks. Student perception on learning did not differ based on reading format. Participants that used an e-textbook during the study made more notations into the text verses their counterparts that used print textbooks. An interesting find what that participants that were in the printed textbook group were twice as likely to report that they did not take notes. Like previous studies, the researchers did not indicate that there was instruction provided in regards to using any of the features installed in the e-textbook; rather, there seemed to be an assumption that the students automatically knew how to use the features.

A commonality of these studies is the lack of cognitive strategy instruction (summarizing, activating prior knowledge, etc.) or even an indication from the participants that they were metacognitive or used metacognitive strategies. The lack of cognitive or direct instruction in the aforementioned studies sheds a light on the importance of the current study, and show a gap in the literature on the importance of not only providing reading comprehension strategies to pupils, but also be mindful about providing instruction to students on how to maximize their reading experiences when reading digitally by teaching students how to access built in digital features.

Comprehension Strategies

In 2000, the National Reading Panel published an extensive report on the state of reading. Within this report, prominent researchers in the field of reading education gathered quantitative experimental studies about the diverse struggles in reading, including one primary struggle being reading comprehension. The report described top strategies that were effective in tackling diverse issues in reading comprehension. Participating researchers noted that these “strategies are problem-solving procedures readers can use independently of the teacher; reading comprehension strategies are tactics to understand and remember key ideas in reading” (NRP, 2000). Reading strategies provide a cognitive approach for readers to monitor their own comprehension. Unlike skills, which often are done with automaticity, strategies take intentional effort and explicit instruction to become a skill. If explicit instruction is not provided to readers, then it is unlikely that these reading strategies will develop over time (NRP, 2000). Dole, Nokes, and Drits (2009) defined strategies as “conscious, deliberate, and open to inspection” (p. 350). Paris et al. (1983) stated strategies can be difficult to learn and employ but are useful tools for beginning and struggling readers. Dole, Nokes, and Drits (2009) stipulated in order for a reader to use any type of strategies, the reader, whether beginning or low-achieving, must have a purpose for reading and an understanding of actions or strategies that are available to accomplish the reading task. In order to employ a strategy, a reader must have knowledge of the strategy. Having knowledge of what strategy to employ to accomplish a reading goal connects to the 1983 work of Paris et al. work on declarative, procedural, and conditional knowledge. Knowing what strategies are and which strategies are useful in accomplishing a task is declarative knowledge. Procedural knowledge refers to "how to employ those strategies" (Paris et al. 1983, p. 303). Conditional knowledge offers an understanding of when and why the strategies were applied.

After analyzing a variety of studies, the NRP (2000) identified a number of strategies as the most effective strategies to comprehend text. Those strategies include summarization, question generation, forming question-answer relationships, visualization, and story structure analysis. Of those strategies, the NRP identified summarization and question generation as the most effective in reading comprehension. Question generation prompts the reader to develop questions in order to quiz himself or herself on a text. This strategy allows the reader to check understanding while actively engaging in reading and monitoring individual comprehension. The NRP reports that there is strong empirical and scientific evidence to support that the instruction of question generation during reading, as well as integrating and identifying main ideas during summarization, benefits reading comprehension in terms of memory and answering questions about texts (NRP, 2000). However, it is not enough to instruct students to generate questions while reading; students need to be taught how to generate effective questions that prompt deeper thinking.

In a landmark study, Davey and McBride (1986) used explicit instruction to teach sixth graders to ask good questions. During the study, the researchers provided direct instruction and modeled the techniques that were taught to participants. In addition to modeling how to build good questions, the researchers also provided participants with feedback for question generation. The researcher's focus was to prompt students to evaluate their questions based on three criteria (1) Was important information covered?; (2) Did the question connect information?; (3) Could participants answer their generated questions? The overall goal of this study was to teach students to move beyond merely building literal or fact-based questions that could be answered by looking in one sentence or passage in the text. The outcome should instead be for students to build inferential questions that require them to connect their background knowledge and "put together" sections of the text in efforts to answer those questions. Readers' abilities to generate and answer inferential questions indicate that they are actively involved in reading (NRP, 2000).

Summarization is another top-ranked, empirically-based reading strategy that helps readers acquire the "gist" of text (NRP, 2000). It allows readers to focus on the main points of text. The NRP argues that providing students with summary instruction helps to improve their individual summaries and hone in on the main points or ideas about texts (NRP,2000; Olson & Gee, 1991; Rinehart, Stahl & Erickson, 1986). The National Reading Panel also suggested reading strategies could help to improve memory for what is read, both in terms of free recall and answering questions. Researchers also point out that summarization activities help learners focus on the important ideas in a text and integrate these ideas by building relations between them (Hidi & Anderson, 1986; Wittrock & Alesandrini, 1990).

In a recent study on summarization, Leopold, Sumfleth and Leutner (2013) examined whether students better understand science texts when they are asked to generate their own summaries or to study predefined summaries. Seventy-one tenth-grade students participated in the study, and results showed that studying predefined summaries in a pictorial representational mode facilitated deeper understanding.

e-Textbook Strategy Instruction

To date, no research has been published that focuses closely on the integration or connection of e-textbooks with pre-existing strategies. Instead, researchers are choosing to focus on the differences and similarities (Daniel & Woody, 2013; Grimshaw et al., 2007; Jones & Brown, 2011; McGowan, Stephens & West, 2009; Park, 2008; Rockinson-Szapkiw et al., 2012) of reading and/or learning from a traditional printed textbook in comparison to an e-textbook.

Sloan's (2013) pilot research looked at students' perception of the usefulness, ease of use, and enjoyment of reading from an e-textbook in a semester long system analysis course at a university. During this pilot study, a demonstration was provided on the built-in features of the e-textbook such as highlighting, annotating, searching, using a ruler, previewing pages, accessing notes, and using a go-to-page function. The researcher requested students to review the iPad user guide in order to become familiar with the iPad. The results reported that 26 participants thought e-textbooks made it easier for them to learn, and they preferred the e-textbook to a printed textbook.

Dobler's (2015) research on e-textbooks also discussed providing instruction on e-textbook features and connecting reading strategies while reading from e-textbooks. In Dobler's study, 56 pre-service teachers enrolled in an English Language Arts class used an e-textbook. Dobler's research focused on students' textbook preferences, perceptions of using an e-textbook, and views on the role of an e-textbooks. The researcher provided participants with an introduction to using e-textbooks using a display projector. Features included highlighting, note-taking, and the search function were explained and modeled. Unlike Sloan's study, Dobler took particular care to instruct participants on specific digital reading strategies. These reading strategies were not outlined in her study, but during a phone interview (2016) Dobler explained how she directed students to access the table of contents while reading in order to seamlessly shift to different places in the text while reading. Dobler found the table of contents was beneficial for students, as it helped them keep track of where they were in their reading, since the e-textbook does not provide sufficient pagination. She found issues of pagination to be a primary concern for her students, as they often felt lost in the reading. To resolve this, Dobler drew attention to the availability of the table of contents, which helped her students stay on track. If something as simple as showing students how to find their place while reading from an e-textbook in order to interact with different sections of the text to connect information has a positive impact on students reading, imagine if students were directed on how to use all the features built in the e-textbook to maximize their reading experiences. This is the goal of my study, to instruct students how to make connections on how the features of an e-textbook should prompt them to use effective reading strategies to comprehend text.

Scaffolding Strategies

A large number of educators and researchers have used the term “scaffolding” as a metaphor to describe and explain a way in which educator’s guide learning and development (Daniels 2001; Hammond 2002; Krause, Stone 1998). First used by Bruner, a psychologist and instructional designer, in 1960, scaffolding refers to temporary support provided by the teacher, more capable peers, or computer tutors to help students solve a problem or carry out a task that they cannot accomplish independently (Vygotsky, 1978; Wood et al., 1976). In the field of education, scaffolding is a process in which teachers’ model or demonstrate the problem-solving process to students and then offer support to students on an as-needed bases (Firestone, n.d.).

Question-Answer-Relationship (QAR) is a scaffolding technique used to teach students how to generate questions that assist in understanding text (Raphael, 1984). Although the goal of QAR is to instruct students on how to distinguish between the types of questions, this exposure, consequently, teaches students to develop good questions. QAR categorizes questions into four types: “right there,” “putting it together,” “writer and me,” and “on my own.” QAR offers a commonality in language amongst students and teachers, but most importantly teaches students that answers in relation to the reading will either come from their text, head, or by combining knowledge with text clues (Lawrence, 2015).

“Right there” questions focus on building questions that can be answered from a single sentence in the text (Raphael, 1984). These surface-level questions require little thought and ask about obvious details in text, such as facts or names. An example of a “right there” question may be, “What is fructose?” In order to answer these questions, readers have to do very little reading and thinking.

“Putting it together” questions require the reader to piece together ideas presented in multiple sections of text in order to provide an answer (Raphael, 1984). An example of a “putting it together” question would be answering a “check-all that apply” question about the functions of fructose in the body. In order to answer this question, readers need to have a clear understanding of fructose and have read about its purpose and performance in the body.

“Writer and me” questions are similar to “putting it together” questions, but they differ in that they require readers to rely on what they already know about the information presented in the text (Raphael, 1984). “Writer and me” questions necessitate that readers connect their previous knowledge with the information presented in text. Questions of this type are slightly more difficult to generate and assess, as they tend to be more subjective and partially based on individual experiences. Potentially, readers could ask themselves how much fructose he or she consumes daily. Answers will vary as this question is partially built from a reader's personal knowledge and experiences.

Answers to the final type of question, "on my own," are never found in the text, and readers are solely using what they already know about the text's subject (Raphael, 1984). In some cases, readers might have no prior knowledge about the subject, hence the danger and ineffectiveness of asking this question in content areas such as science. "On my own" questions are typically open-ended questions and may elicit low-level thinking, and are based on the reader's opinions and experiences (Raphael, 1984; Lawrence, 2015).

After considering the four types of QAR questions, the most efficient QAR category of questioning is "putting it together," or "think and search" as it prompts readers to develop higher-level thinking questions and to synthesize text by piecing and connecting. Although the answer is found in the text, it is not in one section of the text. It the responsibility of the reader to piece together, and analyze multiple sources of information presented in the reading to arrive at a correct response (Lawrence, 2015).

There are many activities that teach students how to reduce text to a smaller, manageable summary, but the issue with these activities is that they fail to teach students the essentials of building an effective summary. Kintsch and Van Dijk (1978) developed six rules to create an effective summary. Ironically, these rules were later reduced to three memorable rules. These rules are important to the study as they will assist students to reduce large sections of information into memorable smaller sections, while using the annotation feature to develop summaries.

The first step for readers is to delete trivial information. This can be difficult for students to do, as informational text is supposed to present pertinent information that can be applied at a later time, so one could assume that all information is important. However, some information included in text is not necessarily worth remembering. For example, unless it is connected to a world event, dates are unnecessary to remember; they are minute details. Setting aside trivial and redundant information allows the reader to focus on important ideas that are linked to many other ideas in the text (Murray, 2012).

After readers delete information that is not important, they will move on to the second step, which is to superordinate items, terms, and events presented in the text. For example, a very basic superordinate term for fructose, sucrose, and lactose would be sugar. The final step in Kintsch and Van Dijk's (1978) summarization rules is for students to compose a statement, which is typically one sentence, that covers the main points of the texts. This provides readers with an overall snapshot of the text. The generated statement, typically referred to as a topic sentence, provides the topic of a paragraph and the main points the writer is conveying about that topic (Murray, 2012).

"About-point" is a strategy that supports Kintsch and Van Dijk's rules of summarization (Morgan, Meeks, Schollaert, & Paul, 1986) and sought to help students identify, construct, and summarize the main ideas of a text. The "about-point" strategy helps students focus on the most important parts of the text—a necessary skill for comprehension.

The first step in "about-point" is for students to read one paragraph or a short section of text. Afterwards, students should write down what they think the topic is about (the "about" portion of this strategy). Next, students explain what the author wanted to say about the topic (the "point"). Finally, students write statements that combine the "about" and the "point." Employing these steps will assist students in building cohesive summaries, which allows readers to capture the most important details about a particular passage. About point is a scaffold for summarization that essentially accomplishes four task as described by Lawrence (2015): 1. It introduces the QAR question types. 2. It teaches students about the clues for identifying the question types. 3. It is a strategy that can be modeled by a teacher 4. It teaches students about text organization.

Students must be taught how and when to apply these strategies, which require students to be metacognitive. Wilson explained, “Teaching students how to be metacognitive requires instruction in cognitive strategies as well as instruction in when and why these strategies are applied” (Wilson, 2011, p. 33). Cognitive strategy instruction is an approach that involves teaching students about the strategies for learning, thinking, and problem solving (Livingston, 1997; Pintrich, 2002). Wilson (2011) also noted visualizing, summarizing, questioning, and predicting can be included in cognitive strategy instruction. “About-point” and QAR are both strategies that rely on summarizing and questioning.

Current Study

The research on the use of e-textbooks is growing, but few researchers have explored the importance of teaching students effective reading strategies as a means to comprehend digital text. Furthermore, researchers have failed to demonstrate the importance of teaching students how to use technology for academic purposes instead of for entertainment and leisure.

This study added to the discourse on the effectiveness and proper integration of e-textbooks into academics. It uncovered the necessity of providing direct instruction to students on how to integrate the features of the e-textbook with pre-existing strategies to comprehend digital text. This study showed how students metacognitively interact with an e-textbook and self-regulate their learning in an academic setting. Lastly, this study provided a voice for users of required technology to discuss their feelings on the best support for comprehension while reading from an e-textbook during focus groups.

Chapter Summary

Three theoretical frameworks informed the conceptual framework and design of the current study: metacognition, self-regulated learning, and New Literacies. The strengths of these theories helped to illuminate the importance of metacognitive and cognitive strategy instruction and the use of an e-textbook in a classroom setting. While the literature on e-textbooks is growing, there is still a lack of attention paid to how instructors might provide direct instruction on reading strategies and electronic features to students that use the e-textbook for academic purposes. This study helped to inform the importance of providing instruction and gather an understanding of students' metacognitive strategy use and subsequent cognitive processes or regulation while reading from an e-textbook.

CHAPTER 3: METHOD

The research question examined in this study is as followed: How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension? To further illuminate students' metacognitive interactions and feature preference, I generated two sub-questions: a. How are students metacognitively using features of the e-textbook? b. What features of the e-textbook support comprehension?

Below, I provided a layout of the research questions that drove this study. From those questions, I identified and operationally defined the independent and dependent variables of this study.

Research Questions:

1. How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension?

The independent variable (the variable being controlled by the researcher) is the type of strategy instruction participants receive, which is operationally defined as the presence or lack of presence of strategy instruction activities during this study. The treatment group received direct instruction on comprehension strategies and how to use features of the e-textbook with those strategies. The control group received direct instruction on comprehension strategies only.

2. In which ways are students metacognitively using features of the e-textbook?
3. What features of the e-textbook support comprehension?

The first dependent variable tested and measured participant comprehension. I operationally defined comprehension as the total score students received on the content pre-and posttest. The second dependent variable was metacognition. I operationally defined metacognition as the presence of metacognitive strategies and the identification of specific metacognitive category.

Participants

Participants in this study included 24 eleventh-grade students enrolled in a general education physical science course. The participants (n=24) were sampled from a larger population of 69 eleventh-grade students enrolled in three sections of a general education physical science course offered during Spring 2016 that included students with disabilities. Of the 69 students enrolled in the physical science class, 24 students presented the necessary student and parental consent to participate in the study.

The following section will begin with descriptive statistics about the school, teacher, participant observer, and the pool of 24 consenting participants. Next, it will outline the sampling criteria that led to the selection of the final 24 participants. Finally, it will provide descriptive statistics about the 24 participants.

Setting

Participants were enrolled in a public, rural high school in the Southern United States. The school has a total enrollment of 603 students and 155 eleventh-grade students. The school population was 58% African American, 37% White/Caucasian, 2% Hispanic, and 1% Asian/Pacific Islander (National Center for Education Statistics, 2015). I selected participants from three sections of a general physical science course with a total of 69 students.

Of the 69 students in the physical science classes, 24 students and parents consented and assented to participate. In the group of 24 students, 66% were female and 33% were male. The students’ self-reported ethnicity was 32% Caucasian and, 68% African American. In comparison to the overall school demographics, the sample used in this study accurately depicts the demographics in the overall school with most students being African-American or Caucasian. I examined the differences between the school and sample demographics using a chi-square test and the results determined that sample reflected the overall school population ($p > .05$).

A male teacher taught all three classes—a teacher with a Bachelor's of Science in Bio-Medical Science and Chemistry and two years of experience teaching science. Although the teacher was working on an emergency certification, he was in the process of becoming certified to teach. I acted as a participant observer during the course of the study. I have four and a half years of teaching experience in grades nine through 12, as well as three years of co-teaching at the college level as a graduate teaching assistant. I have a two masters' degree in Educational Leadership and in Reading Education. The participant teacher and I collaborated and co-taught by integrating reading comprehension strategies with physical science content while connecting those strategies to features of the e-textbook used in one of three sections of the physical science courses. I provided training to the teacher on teaching metacognition and presenting think-alouds to the participants. This was done twice a week over a span of two weeks for an hour each session after school, resulting in four training hours. First, I provided background knowledge about the theory or concept, and then discussed and showed how the theory or concept could be applied to the physical science content. In sessions 2 thru 4, we did mock presentations demonstrating how to deliver the instruction to students in each group.

The students in the participating classes were accustomed to a traditional model of teaching physical science. In class sessions prior to the study, the teacher assigned portions of text for students to read. The teacher then either gave students a reading guide to complete once the reading was finished and/or provided a lecture using a power point presentation that was later be loaded onto Schoology (a learning management system) and made available for students to view. While lecturing, the participant teacher used his iPad to control the presentation, which gave him a higher level of portability, as his desktop would confine him to the back of the classroom. Assessment was usually conducted by paper-based test. The participant teacher tested students on vocabulary presented in each section of the chapter and conducted a cumulative chapter exam. Prior to the beginning of this study, students had completed an extensive unit on electricity.

In accordance to the one-to-one technology initiative, students in grades 10 through 12 were provided with either an iPad 2 or an iPad 4 with 16 gigabytes (GB). In addition, ninth-grade students were provided Chromebooks. However, due to unforeseen circumstances (e.g., financial strains, misplaced materials), each student did not have access to an iPad. Out of 69 juniors enrolled in all three sections of the physical science course, 38 students had physical possession of the school-issued iPad. The criteria used to participate in this study included (a) access to an iPad, (b) enrollment in a high school physical science course and (c) the physical science e-textbook loaded on their iPad.

Materials

Teacher interview. At the beginning of the study, I scheduled a meeting to interview the participating teacher to gather information about his academic and professional experiences with technology. The participating teacher asked a total of five open-ended questions, and the interview lasted roughly 45 minutes (See Appendix A for interview questions). The interview allowed me to gauge his comfortability with literacy strategy instruction, experiences with technology integration, and how he used the e-textbook in his science courses. The interview not only provided insight about the participating teacher, but also the culture of the school. I recorded the teacher interview responses using an iPad while the interview took place. In addition to recording the interview, I took field notes to make note of concepts I wanted to reflect on while transcribing the interview. I organized the responses by question. I read the transcripts as a whole, and then read as it pertained to each question. I then drew out major concepts from each question such as technology integration and professional development. I coded by hand because the teacher interview was manageable. The main overarching codes were professional development experiences with technology integration as published research cites teacher technology apprehension is due to the low amount of professional development offered from the district or school. Sub codes that emerged were school policy and student instruction. (See Appendix B for codebook.)

Student iPad. Each participant in this study had access to a school-issued iPad 2. On that iPad, students had access to Readle's Document application (app) which gave students the capability to read PDF, Microsoft, and other documents easily, and iBook app, which was initially used to access and read from their physical science e-textbook. For the purposes of this study, participants required access to their e-textbook and the Readle's Document app. I chose this app because it provided additional features like highlighting, note-taking, bookmarking, etc., that iBook did not offer.

Physical science e-Textbook. The physical science textbook was copyrighted in 2005 by McGraw-Hill Companies, Inc. The textbook covers six units that range from energy to matter. The textbook content is aligned with the state's course of study.

In order to determine the reading level of the physical science e-textbooks, I performed the Smog and Flesch-Kincaid readability test. I performed the Smog Readability test on a student edition of the physical science textbook. I used the Smog Readability test to determine the years of education a person needs in order to comprehend a piece of writing (McLaughlin, 1969). To execute the test, I selected 30 sentences from the beginning, middle, and end of the text or passage, and special attention is paid to words with three or more syllables. Words that qualify as polysyllabic are totaled, and the grade level is determined by using the Smog Conversion table. The grade level of the physical science textbook used in this study was found to be at the tenth-grade level using Smog. The Flesch-Kincaid readability test is said to be the most widely validated and most used in comparison to other readability tests (Kincaid et al., 1995). Its original purpose was to provide intelligence on reading comprehension for the Navy; however, the formula is also suitable to use in the field of education. There are four steps to measure readability using Flesch-Kincaid formula: 1) calculate the average number of words used per sentence; 2) calculate the average number of syllables per word; 3) multiply the average number of words by 0.39 and add it to the average number of syllables per word multiplied by 11.8; and finally, 4) subtract 15.59 from the results. Microsoft word offers the ability to run a Flesch-Kincaid readability test on any document, and to alleviate any potential miscalculations, I used this program to calculate readability. The test determined that the measured text was 9.8, which qualifies for the ninth-grade level.

To provide students with an e-textbook, the school converted a print copy of the traditional physical science textbook to a portable document format (PDF) file. The school's file transfer protocol server received a PDF of the e-textbook to be downloaded to the iPad for student consumption and then distributed to students that requested the electronic format.

Classroom observations protocol. I observed teacher and student participants for a total of eleven weeks. The observation protocol assisted in focusing and organizing daily observations (See Appendix C for observation protocol sheet). There was a mixture of five closed and open-ended questions to be answered during observations. The first question collected data about the daily presence of iPads. This question helped me to determine how many students had their iPad in class, and observe the students' purpose and interaction with the device, whether academic, personal, or both. Question two on the observation protocol helped me to determine student reading platform preference during independent reading assigned by the participant teacher. Question three helped me to keep a tally on what strategies in particular students used while reading from the e-textbook. Question four helped me to keep a tally on student usage of e-textbooks. Finally, question five accounted for any additional external resources that students used to assist in comprehending the e-textbooks that were not directly taught to them at the beginning of the study. As mentioned prior, the observation protocol sheet had a mixture of check-list and field notes to add to the fidelity of this study. The check list added to the rigor or trustworthiness by pointing out key elements in this study, and the field notes helped to expand further on those elements. Observation protocol fidelity criteria, used as a manipulation check in treatment effectiveness research, are necessary to ensure internal validity (Hohmann & Shear, 2002). I organized observation protocol sheets by data, treatment, and comparison groups. After I read and organized the transcriptions they were coded using the codes and themes. (See Appendix B for codebook.) I coded the observations by hand and collaborated with the participant teacher to synthesize observations during after school debriefings during weeks 4 and 5. For the first three weeks, I observed teacher and student participants' interactions with the e-textbook. I paid close attention to how the student participants employed strategies to comprehend the physical science e-textbook. Once groups received specific interventions, I used an observation protocol sheet to observe student participants. I identified the selected participants with 1) physical possession of an iPad, 2) participants using the iPad for learning, 3) participants using the iPad for other purposes, and 4) participants reading from an e-textbook for observation.

I also looked to see if participants used taught strategies and features while reading independently from the e-textbook. At the conclusion of the experiment, I analyzed the observation protocol sheets by using codes and themes to organize information.

e-Textbook survey. Prior to intervention instruction, participants responded to a 24-item survey that assessed their knowledge of comprehension strategies, ability to use the iPad for reading purposes, and knowledge of features integrated into an e-textbook. The questions presented in the survey were dichotomous as they gave students the option to either answer yes, no, or unsure. Cameron and Quiggin argued that dichotomous questions help to minimize participant bias (1994). The survey also allowed participants to provide pertinent demographic information such as gender, age, grade, and ethnicity. (See Appendix D for the e-textbook survey.)

Student physical science pre/posttest. Each student completed a 20-item, multiple choice pre-test at the beginning of the study. The function of the pretest was to measure students' prior knowledge, which included Waves and Classification of Matter. The participant teacher and I generated the pre- and posttests. We generated the pre-and posttest based on chapter 10 subsections objectives. Furthermore, we applied Raphael's (1984) question generation strategy to develop a mixture of right there, putting it together, writer and me, and on my own questions. To examine test reliability and difficulty, we compared the test questions to the participant teachers final cumulative examine to check if we were covering the chapters' big ideas. Finally, a week after we developed the test, I took the test without using the book as a resource to determine difficulty and test question clarity. I also tallied and categorized the types of questions we developed based on QAR to determine if there was a diverse mixture. Student participants took a posttest that covered that same content as the pretest to test their knowledge after teacher instruction and group interventions were completed. (See Appendix E and F for pre- and posttests.)

Student i-MARSI Survey. I used the *i*-MARSI survey to measure participants' metacognitive awareness reading strategies Cardullo, Wilson, & Zygouris-Coe's (2015, 2016) while reading from an e-textbook (See Appendix G for i-Marsi Survey). The survey consisted of 39 items that students answered using a Likert-scale which ranged from 1-5, with 1 being "I never or almost never do this" and 5 being "I always or almost always do this." Subscales tested on the *i*-MARSI were device supported metacognitive strategies (DSMS) which has an alpha coefficient of .91 and self-monitoring metacognitive strategies which tested .88; both subscale items indicate high reliability. The internal consistency reliability alpha coefficient for all items in the *i*-MARSI was .932 which indicated high reliability of the *i*-MARSI.

The *i*-MARSI, adopted from Mokhtari and Reichard's (2002) Metacognitive Awareness Reading Strategy Inventory (MARSI), identified Global, Problem-solving, or Support reading strategies self-identified by a reader while reading from traditional text. Similar to the *i*-MARSI, the MARSI (Mokhatari & Reichard, 2002) allowed readers to self-report and "increase their metacognitive awareness and strategy use while reading" (p. 255) or as an assessment to provide information for the teacher on the student's reading ability. Based on responses from the 30-item self-reported survey, a readers' strategy usage would classify as either global, supportive, or problem-solving. Global reading strategies are metacognitive in nature and range from, but are not limited to setting a purpose for reading, activating prior knowledge, predicting and previewing, and making decisions about text (Mokhatari & Reichard, 2002). Problem Solving strategies may include close reading, visualizing, reflecting and/or rereading the text (Mokhatari & Reichard, 2002). Finally, support reading strategies include tangible interactions with the text such as taking notes, underlining text, and writing summaries (Mokhatari & Reichard, 2002). Cardullo et al's. (2015, 2016) modified version specifically assesses which group of strategies (e.g., device-supported metacognitive strategies or self-monitoring strategies) a reader uses most while reading text on an iPad. Like global reading strategies, device-supported metacognitive strategies can include, but are not limited to, setting a purpose for reading, previewing text for content by scrolling, and paying attention to text features (Cardullo et al., 2015, 2016). Similar to support reading strategies, self-monitoring metacognitive reading strategies may include, but are not limited to, taking notes electronically, using features of the iPad to listen to text annotations, and/or socially interacting or collaborating to produce comprehension of text or online information (Cardullo et al., 2015, 2016)

Scaffolds. Participants received multiple layers of strategy instruction throughout this study. I provided students with two reading comprehension strategies (summarization and question generation) and explicitly taught multiple features of the e-textbook (highlighting, note-taking, strikeout, bookmarking). Participants received two strategies in an effort to create awareness of metacognitive strategies to fix comprehension breakdowns. Students learned, practiced, and modeled Kintsch and Van Dijk's (1978) summarization strategy rules and question-answer relationships (QARs). The cooperating teacher and I taught as a team in efforts to marry the physical science content with reading comprehension strategies.

After students received instruction on strategies and features, the cooperating teacher continued to model metacognition and the connection of features and strategies. The cooperating teacher accomplished modeling metacognition by using a think-aloud protocol, which included verbal identification of the following: what the strategy consisted of why the strategy was used and when the strategy was used (Wilhelm, 2001). I specifically taught students how to access and operate the features of the e-textbook, and the cooperating teacher instructed the students on the use of those features when applying the aforementioned reading comprehension strategies. The participant teacher and I devoted three class periods to provide students with direct instruction on the strategies and e-textbook feature connection to each physical science section.

Focus groups. I analyzed and compared participant pre- and post-content data scores in order to group participants into one of three groups. To qualify for group A, results from the participants' posttest exam needed to show improvement in comprehension. To qualify for group B, results from the posttest exam needed to indicate a decline in content comprehension. Finally, to qualify for group C, participant post-test scores on content needed to stay the same as pre-test scores.

Once grouped accordingly, participants took part in focus group interviews. Focus groups provided me with student perspectives on what particular strategies and e-textbook features assisted or distracted in the comprehension of the physical science textbook, which helped to answer research question three of this study, which examined what features of the e-textbook support comprehension. Focus groups also offered insight on the metacognitive strategies used by the different types of student based on pre-and post-scores. I expected students who received direct instruction on connecting features of the e-textbook to reading comprehension strategies would do better in comprehending text from an e-textbook. These focus groups lasted no longer that 15 to 20 minutes each, and I audiotaped and transcribed for subsequent analysis. (See Appendix H for focus group questions.)

Design

I used an explanatory sequential design method in this study in which I analyzed both quantitative and qualitative data with the purpose of enhancing and enriching findings.

According to Creswell and Clark (2007), in this design, "the researcher begins by conducting a quantitative phase and follows up on specific results with a qualitative phase" (p. 82). In this explanatory sequential design, the qualitative phase will explain the results of the quantitative phase. The purpose of this study is complementarity, which Greene, Caracelli, and Graham (1989) described as "seeking elaboration, enhancement, illustration, clarification of the results from one method with the results from another method" (p. 257). This follow-up purpose seeks to answer two questions with different methods. In this study, I measured comprehension, metacognition, and e-textbook feature knowledge quantitatively in pre- and post-study surveys and tests, but I measured student perspective on feature usefulness qualitatively. Quantitative data collected during this study qualified as quasi-experimental, as I studied three intact classrooms prior to the implementation of intervention (Fraenkel, Wallen, & Hyun, 2012). This is consistent within the educational system, because class enrollment is already predetermined. To compare and contrast comprehension with using e-textbooks accompanied with instruction, it is important to perform pre- and post-tests on participants.

Procedure

I conducted the study over 11 weeks during the Spring 2016 semester. The participating classes met Monday through Friday for a 50-minute period. There were a total of three physical science classes that met during periods two, three and seven. In efforts to create two comparable groups, I combined period three and seven to make one group, and period two stood alone as another group for the purpose of this study. For the first three weeks of the study, I observed how the teacher and students interacted with the school-issued e-textbook for a total of 7.5 hours, which is represented by nine 50-minute class periods per week. During those three weeks, I conducted an interview with the participant teacher to understand his thoughts on the integration of technology and use of strategies in the classroom. Furthermore, I taught the participant teacher how to connect e-textbook features to summarization and QAR during those three weeks. The second week of implementation, I administered the content pre-test to acquire a threshold of what the student participants knew about the content that would be taught during the course of the study. Also during the second week, I administered the e-textbook survey to gather student participants' perspectives on what they think they know about general comprehension strategies, use of the e-textbook, and features of the e-textbook. Finally, during week three, the student participants took the *i*-MARSI (Cardullo et al. 2015, 2016) survey to determine how student participants thought and what features they used while reading from an iPad.

During week four, the researcher and teacher participant provided direct instruction to group one on the connection of e-textbook features (e.g., highlighting, note-taking, strike-out, bookmarking, and defining) and how to use those features while summarizing sections of the science e-textbook. Although only 24 students consented, I provided specific instruction to all 69 students. To disseminate instruction to students, the researcher and the participant teacher collaborated. First, the I provided instruction on Kintsch and Van Dijk's (1978) three summarization rules: delete trivial information, superordinate terms, and generate a topic sentence. After the I provided information to the students about the three rules, I led a classroom practice on applying the rules to a piece of text unrelated to science. The participant teacher then modeled the application of the three rules to a section of the physical science textbook and allowed students to ask questions and discuss the material. After the participant teacher modeled the use of summarization strategy rules, I provided direct instruction on how to access and customize features of the e-textbook while reading. After the instruction was provided, the students worked independently on an activity that required them to access and use features of the e-textbook while reading the first assigned section of Chapter 10: Waves. After student participants received instruction, I observed if the student participants applied and connected features and strategies. In group two, students were taught how to apply the same summarization rules while reading, but feature instruction was not provided to students. Instead, it was only used by the participant teacher. Participants were observed for one week before the next intervention was taught.

During week six, student participants received direct instruction on how to generate question via QAR activity. The treatment group (group one) received instruction how to use the features of the e-textbook to assist in generating questions. Specific attention was paid to using the sticky pad feature to write questions and to using the highlighting feature to call attention to pertinent information in the text. After I provided instruction on strategies and feature connection, the participant teacher continued to model the process of generating questions and connecting the strategy to the e-textbook features. In group two, student participants received instruction on how to generate questions, but they were not instructed on how to connect that strategy to the features of the e-textbook. It is important to note that the teacher participant still used the features while discussing the strategies, but he did not explain to student participants how to access the features. I continued observations for two additional weeks to see if students were applying the strategies and features while reading independently from the physical science e-textbook.

Figure 3

Research Schedule of Activities.

Week	Activity
Weeks 1-3	• Teacher interview • Teacher and student observations • e-Textbook Survey • Content pre-test • *i*-MARSI pre-survey
Weeks 4-5	• First round of interventions • 2^{nd} and 3^{rd} hour: (strategy plus feature) summarization and features 7^{th} hour: (strategy) summarization • Observe students' application of interventions
Week 6	• Second round of interventions 2^{nd} & 3^{rd} hour: (strategy plus feature) question generation and features 7^{th} hour: (strategy) question generation (QAR) • Observe students' application of interventions
Weeks 7-8	General student observations
Week 9	Content Posttest
Week 10	*i*-Marsi Post Survey
Week 11	Focus group interviews • Monday (only improved participants) • Tuesday (only stayed the same participants) • Thursday (only declined participants)

In the final weeks of the study, I administered a post-test to student participants to test comprehension of physical science content. The student participants also gave additional responses to the *i*-MARSI survey to compare individual results of the pre-*i*-MARSI survey to see if a change had occurred in metacognition after participants received direct instruction on the features of the e-textbook and applicable reading comprehension strategies. I measured comprehension using a repeated measure or mixed ANOVA to compare mean differences in student strategy usage between the treatment and control groups. Further, I used a mixed ANOVA to determine differences in the mean scores of students, which was self-reported by the participants.

Analysis of data

Research question one. How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension? To answer this question required the use of multiple instruments. The qualitative instrument used to answer the concept of instruction derived from the teacher interview. I recorded the interview using an iPad and took field notes during the interview. I transcribed and organized the teacher participant responses by question and read through the interview looking for insight on technology integration and professional development which I later used as codes. Creswell determined that reliability can be obtained if the researcher takes detailed notes while recording and then transcribing the tape (2013). To measure student participants' comprehension, I used a pre-and posttest instrument in this study. Furthermore, I used an observation protocol to triangulate images, recordings, and observation during instruction post intervention. To analyze the data presented in each test, I used a 2 X (2) mixed ANOVA to determine comprehension differences amongst the experimental and comparison groups. This design consisted of one within subject variable, with two levels (pre-and post), and one between subject variable (intervention), with two levels (strategies + features and strategies only). I developed and disseminated the student survey using Qualtrics. I developed the anonymous student survey and an assistant professor with experience developing surveys provided inter-rater reliability. After I developed the survey based on over-arching concepts of e-textbook and strategy usage, I e-mailed the survey for the assistant professor to complete and critique. After this was completed, we met digitally for two and a half hours to discuss the layout, structure, concepts covered and clarity of questions presented in the survey. The goal was to achieve 75% agreement in the concepts covered in each survey question. If this percentage was not achieved, we would discuss how to restructure questions in efforts to articulate concepts more clearly. I gave the assistant professor a list of key concepts I attempted to cover in the survey questions and we matched each question to a concept. We achieved 75% agreement in our interpretations of the questions meaning presented in the survey.

Research sub-question a. I used the *i*-MARSI instrument to answer sub question a: How are student metacognitively using features of the e-textbook? A 2 x (2) x (2) ANOVA was run using SPSS to examine student self-reported data on the type of metacognitive strategies used while reading from an e-textbook. Since there are two dependent variables used in this study a MANOVA would have been more appropriate, but due to low power, I used a 3-way factorial analysis. Analyzed in the 2 x (2) x (2) ANOVA was the interactions between time (pre-and posttest), groups (experimental and comparison) and finally strategy type (DSMS and SMMS). I compared group means scores and analyzed the i-MARSI's validated scale to determine mean average (high, medium, or low) differences in pre-and posttest. (See Appendix G for *i*-Marsi survey.)

Research sub-question b. I used the observation protocol and focus group interviews as instruments to answer sub-question b in this study: What features of the e-textbook support student comprehension? Similar to research question one, the observation protocol acted as a tool to help triangulate observations, interviews, recordings and photographs taken during this study. I recorded focus group interviews by using the iPad, while I took field notes during the interview process. I transcribed and categorized interviews by question and grouped based on comprehension growth within the initial experimental and comparison groups. After I transcribed the focus group interviews, I uploaded each group of interviews into Atlas.ti and read each transcription three times before I applied pre-existing codes. (See Appendix B for a list of applied codes.) I used the same coding system in the observation protocol and applied it to the transcription of the focus group interviews to tease out major themes of technology integration, instruction, and e-textbook feature usage. In addition to applying codes to answer research question b, I also counted the number of times specific participants expressed approval or application of certain features to aid in the reading process to explain participant beliefs about the assistant of features. This will be explained further in chapter four.

Chapter 4: Results

Introduction

I conducted an explanatory sequential design mixed method study to investigate how providing direct instruction to students on the connection of e-textbook features and comprehension strategies would impact student comprehension. Quantitative data collection instruments included a 22-item dichotomous survey that assessed students' knowledge, interaction, and comfortability with e-textbooks and comprehension strategies. I used a 20-item multiple choice pre-and posttest to measure comprehension growth on specific content that would be covered during the experimental phase from the physical science e-textbook. Finally, I used the *i*-MARSI survey, which contained 39 items, as a pre-and post-survey to allow students to self-assess metacognition and the use of features while reading from an e-textbook. Qualitative instruments used in this study included an observation protocol that helped focus daily observations of student interactions with the e-textbook and comprehension strategies. I conducted a teacher interview to establish a threshold of what the teacher believed about his interactions and teaching methods in regards to using the e-textbook. Images were taken as a part of the daily observations to provide evidence and to further inspect student interactions with the e-textbook and comprehension strategies. Finally, I conducted focus groups to establish an understanding of participant perspective on which features they believed best supported their comprehension throughout the experiment.

Research Questions

Examined in the study were the following research questions:

1. How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension?

To assist in gathering a deeper understanding of research question one, two sub-questions were developed and are as followed:

a. How are students metacognitively using features of the e-textbook?

b. What features of the e-textbook support student comprehension?

In efforts to thoroughly answer each research question presented, I measured, analyzed, and integrated data to depict the student experience with combining e-textbook features to comprehension strategies, and how doing this would impact their comprehension. The implications and educational impact of this study is discussed in detail in Chapter 5.

Sample

Initially, there were 24 students that were participants in this study; however, only 22 students lasted the entire 11-week experiment. Mortality posed a threat to the internal validity of this research as multiple students dropped out of the experiment due to various reasons. Due to attendance, discipline, equipment access, and other reasons, the number of participants that interacted with each quantitative instrument varied. The experimental group consisted of two boys and nine girls; however, the comparison group consisted of six boys and five girls. Although participants were evenly distributed in groups, there are substantial differences in the gender make-up of these groups. As mentioned in chapter three, the participating site's population was composed of 58% African American, 37% Caucasian, 2% Hispanic, and 1% Asian/Pacific Islander. In this study, the experimental group was composed of 90% African American, and 9% Caucasian students. The comparison group was made up of 54% African American, 36% Caucasian, and 9% Hispanic, which reflects an accurate depiction of the school's population.

Research Question 1: How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension?

To understand the teacher participant's instructional behavior, and interactions with the e-textbook, I conducted a teacher interview and student survey. To assist in measuring comprehension impact, the teacher participant and I developed a pre-and posttest to measure student comprehension before and after experimental treatment. To establish an understanding of the teacher participant's point-of-view and behavior with the e-textbook an interview was conducted prior to the start of the experiment.

Teacher interview. The teacher participant expressed a desire to use e-textbooks in the classroom, but felt he lacked an understanding of comprehension strategies and how to transfer those strategies to the e-textbook. He questioned whether comprehension strategies were even feasible while using the e-textbook. When asked how often he incorporated the usage of e-textbooks into his instruction, he explained that he did not require the students to bring their iPad to class daily because there was a school-wide device deficit. He described how the school complied with the one-to-one iPad/device initiative; however, the initiative was unsuccessful as a bulk of students either failed to return their iPads, lost, or even broke the devices leaving less than half the student population without a tangible device. Furthermore, he was not equipped with the knowledge to assist students' in downloading the physical science e-textbook onto the device, this was the individual job of the school librarian. When asked about professional development on the integration of e-textbooks into instruction, he indicated that there was minimal development provided. He stated that he received a request from the school administrators to teach teachers how to operate the e-textbook and iPad. He expressed a lack of depth of knowledge on operating an e-textbook, but he understood how to operate an iPad, and that was the focus of his one-time professional development offered to teachers. As mentioned prior, all students in each physical science course did not have access to a device with the downloaded physical science e-textbook. To provide access to all students, he provided each physical science class with a classroom set of textbooks that had to be returned at the end of each class period. He explained that instead he would allow the students to use the iPad as an additional resource instead of a supplant, while simultaneously attempting to not exclude students that no longer had access to a device and put them at an academic disadvantage. In the participant teacher's science courses, there was no direct instruction provided on the connection of comprehension strategies to features of the e-textbook to pupils for multiple reasons: 1. The teacher felt uncomfortable teaching reading strategies to students because he was unaware of the strategies and how to scaffold them effectively. 2. The teacher was unaware of the features installed in the e-textbook. 3. The teacher did not focus on interacting with the e-textbook because majority of his students did not have the technology. Furthermore, observations determined that prior to the experimental interventions, there was no literacy instruction happening in each course.

Although the teacher participant was unaware of reading strategies and features, survey data show that 95% of student participants reported that they use comprehension strategies when they encountered issues while reading.

Student survey. In addition to knowledge of reading strategies, 81% of student participants reported that they were aware of features installed in the e-textbook to assist with reading, while 75% student participants reported that they knew how to access these features while reading from an e-textbook.

Twenty-six students took an anonymous survey on e-textbooks and comprehension strategies. Table 1 provides a condensed illustration of the student's response. The full table can be found in Appendix I. survey prior to experiment and comparison groupings to establish an understanding of student attitudes on e-textbooks used for academic purposes. I reported survey results as the percentage of students indicating either "yes," "no," or "unsure" with the given statement. The corresponding number is indicated in the parentheses. I will discuss the survey responses and connect and integrate the data in chapter five.

Table 1

*Overall student attitudes on e-textbooks (*condensed version in Appendix I)*

Statement	Yes	No	Unsure
Prior to this class, I have experience with using an electronic textbook.	19 (95%)	1 (5%)	0 (0%)
I use comprehension strategies while I am reading.	18 (95%)	0 (0%)	1 (5%)
I am aware that e-textbooks have built-in features (audio, bookmarks, highlighting, annotation, etc.) to help with reading.	17 (81%)	2 (10%)	2 (10%)
I know how to operate an electronic textbook (e-textbook).	17 (77%)	0 (0%)	5 (23%)
I know how to use e-textbook capabilities (audio, bookmarks, highlighting, annotation, etc.).	15 (75%)	1 (5%)	4 (20%)
I have experience with using e-textbooks for academic purposes.	13 (65%)	5 (25%)	2 (10%)
My teacher takes the time to explain how to use features of the e-textbook.	12 (63%)	4 (21%)	3 (16%)
My teacher models how to use features of the e-textbook while reading	8 (42%)	9 (47%)	2 (11%)

Several items demonstrate a mastery and/or understanding of the usage of e-textbooks amongst student participants. Many students (77%) believed that they knew how to operate an e-textbook prior to the launch of said experiment. A bulk of student participants (95%) also reported that they had had prior experience using an e-textbook prior to the study; however, only 65% of students reported using e-textbooks for academic purposes. Although 63% of students believed that their teacher took time to explain the features of the e-textbook, there was a split opinion (42%- yes, 47%-no) on whether the students believed that their teachers modeled how to use the features of an e-textbook while reading.

I conducted pre-and posttests to measure student participant's comprehension growth before and after the intervention. I also used the test to compare differences in comprehension scores between the experimental and comparison groups.

Pre and posttest. Twenty-four students took the content knowledge pretest; however, I only included 22 due to student mortality. The instruments provided data on the difference in knowledge amongst the two groups, and helped to establish a quantifiable baseline of what the students knew about the content presented in Chapter 10 of the physical science e-textbook prior to the experiment and teacher instruction, and once the study concluded. The pre-and posttest instruments assisted in answering research question one as their presence allowed the researcher to measure comprehension impact of student participants. In order to assess the effect of the experimental on the comparison group compared to the experimental on the experimental group, I performed a mixed ANOVA. I conducted a 2 X (2) mixed model ANOVA to examine the experimental groups student comprehension compared to the comparison group. I divided participants within intact groups based on their pre-existing class placements. Table 2 provides data for the differences in the mean score between groups one (experiment) and two (comparison).

Table 2

Mixed-Analysis of Variance Descriptive Statistics of Comprehension in Groups

	Pre-Test	Post-Test
Group	Mean (SD)	Mean (SD)
1 (n=11)	6.63 (1.20)	11.36 (2.65)
2 (n=11)	5.27 (1.00)	7.09 (3.91)

The pre-test indicates that there was not much variation between the mean scores of the two groups in their content knowledge in the tested chapter. Pre-test scores indicated that group one, the experimental group (N=11, M=6.63) and group two, the comparison group (N=11, M=5.27) were similar in the lack of knowledge presented prior to studying chapter ten. The post-test scores indicate that there was growth in the mean scores amongst group one (M=11.36) and two (M=7.09); however, group one, which was the experimental group, shows a substantial increase in the post-test score. There was a significant difference in comprehension over time in this study $F(1, 20) = 24.82$, $p < .05$ which meant that both groups comprehension improved from the time participants took the pre-and post-test. In addition, there was significant difference on the interaction of time and group $F(1, 20) = 4.90$, $p < .05$, which indicates a difference in group changes from pre to posttest. Specifically, the experimental group showed significant gains in comprehension, averaging a mean score of 6.63 on the pretest and 11.36 on the posttest.

Table 3

Mixed-Analysis of Variance Descriptive Statistics of Comprehension in Groups

Source	df	MS	F	P
Between Groups				
Group	1	87.364	11.400	.003
Error	20	7.664		
Within Groups				
Time (Pre-Post)	1	117.818	24.828	.001
Time x Group Interaction	1	23.273	4.904	.039
Error	20	4.745		

I used daily observation protocol sheets to keep track of student usage of the iPad, e-textbook features, and strategies.

Observation protocol. Using the observation protocol helped to provide data to answer the question of comprehension impact, as the lack of iPad presence during the experiment could have an adverse effect on the results. In other words, if a student did not bring their iPad to class, then it was impossible for that student to either receive and/or practice the designated intervention (s). As a part of the observation protocol and attendance, I recorded the presence of participant devices almost daily; however, on instruction days it was difficult to account for all devices as I focused specifically on teaching the interventions. Observational protocol sheets helped to keep track of the participants who did or did not bring their iPads to class. The table below does not indicate whether the students used the device for social or academic purposes; however, this will be discussed as this was component of the observation protocol sheet.

Furthermore, if a student was absent, he/she was not included in the daily tally. On average (M=6.21), the strategy group (comparison) bought their iPads to class with them more often than the experimental group (M=5.28); however, this does not mean that the participants used the iPads for academic purposes. I will discuss this in more detail in chapter five. Table 4 represents a daily breakdown of visibly present student devices.

Table 4

IPad presence comparison between experimental and comparison groups

Date	*Strategies & Features*		*Strategies*	
	Yes	*No*	*Yes*	*No*
1/7	6 (60%)	4 (40%)	6 (66%)	3 (33%)
1/8	4 (44.4%)	5 (55.5%)	3 (60%)	2 (40%)
1/11	6 (60%)	4 (40%)	6 (54.5%)	5 (45.4%)
1/14	4 (50%)	4 (50%)	3 (42.8%)	4 (57.1%)
1/15	5 (45.4%)	6 (54.5%)	8 (80%)	2 (20%)
1/21	6 (75%)	2 (25%)	8 (72%)	3 (27.2%)
1/25	4 (40%)	6 (60%)	8 (80%)	2 (20%)
1/28	6 (60%)	4 (40%)	9 (81.1%)	2 (18.1%)
2/1	6	4	8	3

	(60%)	(40%)	(72%)	(27.2%)
2/2	6	4	8	2
	(60%)	(40%)	(80%)	(20%)
2/4	5	2	3	1
	(71.4%)	(28.5%)	(75%)	(25%)
2/8	6	3	5	5
	(66.7%)	(33.3%)	(50%)	(50%)
2/9	5	3	3	6
	(62.5%)	(37.5%)	(33.3%)	(66.6%)
2/18	3	8	9	2
	(21.4%)	(57.14%)	(64.2%)	(14%)

I used a chi square test to determine the differences in iPad presence between the experimental and comparison group. Results determined that there was no significant difference between the comparison and experimental group, $x^2 (1) = .60 > .05$.

I coded and analyzed protocol sheets to understand how and if students were using and applying interventions while reading from the e-textbook. Results indicated that although students had their devices present in class, a recurring theme was that they preferred either taking physical notes while listening to the teacher lecture or reading from a physical copy of the science textbook, which the participating teacher provided a classroom set in response to the low numbers of available iPads school-wide. The results indicate a 50/50 divide among both groups of having the iPad present in class, but choosing not to engage with the technology; instead, opting to listen to lecture and take physical notes or read from a hard copy of the textbook. This could potentially impact student interaction with the e-textbook, as it is housed on the iPad device. Sub-codes explained why the participants had the iPads in class, but chose to opt out of using the device. The results from the protocol sheets indicate that participant iPads were frequently dead. This sub-code appeared ten times in the comparison group and none in the experimental group. Another sub-code that emerged was the desire to read from a hard copy textbook instead of an e-textbook. Participants in both groups presented equal numbers in the desire to read from print. As the study progressed, data revealed that although the iPad was present, it was not being used because it was disabled due to entering an incorrect passcode from one participant in the experimental group. Feature usage ranked low in both the experimental and comparison groups. Results showed that participants in the experimental group preferred to use the highlighting and the note-taking feature most often. Although participants in the comparison groups were not provided with formal instruction on how to use the features, results showed a higher usage of the sticky-note, defining, and translation features.

To further attempt to explain an increase in comprehension, I contrasted the experimental and comparison groups attendance and iPad presence to account for changes. Data revealed that on the first day of intervention instruction, 10 of 11 students were present to receive instruction in the experimental group, but there were only four iPads in account. Similarly, 10 of 11 student participants in the comparison group were present the first day of intervention instruction; however, there were eight iPads physically present in the classroom. An observation protocol sheet for the days of intervention are unavailable since I provided student participants with instruction. However, based on observations of cumulative field notes, data show that although participants in the comparison group bought their iPads more often there was a difference in behavior in comparison to the experimental group.

As mentioned prior, specific codes that identified students' interactions with the iPad emerged after transcribing the observation protocol sheets and focus group interviews. Three codes that emerged often while transcribing the observational protocol sheets from the comparison group were present-not-using (P.N.U.) which meant that although the student had physical possession of the iPad, he/she chose not to use the tool for reading purposes. The code other meant that the students used the iPad, but not for academic purposes. Finally, the code dead meant that I received verbal confirmation that the iPad was out of battery or I viewed a student participant physically charging the iPad. Data from the observation protocol sheets determined that participants in the experimental group coded far less in other, p.n.u, and dead than the comparison group. Nonetheless, the codes did emerge in the experimental data which could account for the low comprehension mean scores from pre-to posttest. The comparison group coded ten times for other which meant that during the time students interacted the e-textbook, they visited social media, searched the Internet for non-content related items, or used the device as a platform to play music. The experimental group only coded once for other, and half as much for present-not-using. This could impact comprehension growth as students in the comparison group were seemingly less focused on content read from the e-textbook and more interested in using the iPad and its functions for leisure. In addition, the students in the comparison groups' devices were often dead. This could possibly be due to students using their device throughout the day which in turned drained their battery, and because the school was not equipped with charging stations the device was dead upon arrival to their last class period. I noted this code ten times.

In the second round of interventions, I observed low attendance in the comparison group as only four students were in class. Of those four students, three physically had their iPads present. There are no data to determine how the participants used their iPad, as I provided intervention instruction, but it is important to note that students were only taught how to use strategies, so the presence of iPads were not crucial as students could apply these strategies while reading from the printed textbook. In the experimental group, seven of 11 students were present and all students had physical possession of their iPads.

Research sub-question a: How are students metacognitively using features of the e-textbook?

Twenty students took the *i*-MARSI as a pre-and posttest survey. The instrument provided data on the differences in Device Supported Metacognitive Strategies (DSMS) and Self-Monitoring Metacognitive Strategies (SMMS) while reading from an e-textbook between the experimental and comparison group over time. This instrument helped to answer the sub-question: "How are students' metacognitively using features of the e-textbook?" To assess the effect of the experiment on the comparison group compared to the experiment on the experimental group, I performed a 2 x (2) x (2) mixed ANOVA. I conducted a mixed model ANOVA to examine the efficacy of the experimental in increasing student feature usage and/or understanding compared to the comparison group. Like the content pre-and posttest, I divided participants within intact groups based on their pre-existing class placements; however, due to absences and other unforeseen circumstances the groups were unequal (Experimental, N=9 & Comparison, N=11). The *i*-MARSI established pre-existing averages to assess student device supported and self-monitoring strategies by mean scores. Scores that fell into a range of 3.5 or higher in either category qualified as having an expert understanding of using the diverse strategies. Mean scores that ranged from 2.5. - 3.4 in either category qualified as having an average understanding of the diverse strategies. Finally, student scores that ranged from 2.4 or lower were classified as having a poor understanding of strategies. I gave student participants the *i*-MARSI as a pre/post-survey. For both groups, I compared the mean scores from the pre-and post survey and the results indicated that there was no significant difference or change within the mean score for neither DSMS or SMMS. The experimental group mean scores classified student participants as having an average or medium understanding of device supported metacognitive strategies. Self-monitoring metacognitive strategies increased slightly but remained at an average understanding or implementation of strategies. The comparison group also showed no significant differences from the pre/post-test surveys. DSMS results indicated neither growth nor decline in mean scores, and classified students as having an average understanding and/or implementation of strategies while reading from an e-textbook. SMMS scores also indicated that the comparison group had made a slight increase, but not enough to transition to an expert understanding of strategies while reading from an e-textbook.

Table 5

Mixed Analysis of Variance of i-MARSI Scores in both Groups

	DSMS		SMMS	
	Pre-Test	Post-Test	Pre-Test	Post-Test
Group	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
1 (n=9)	3.48 (.822)	3.35 (.525)	2.70 (1.08)	2.92 (.818)
2 (n=11)	3.07 (.618)	3.05 (.834)	2.65 (.808)	2.72 (.765)

There was no significant difference between the experimental and comparison group $F(1, 18) = .618$, $p > .05$ on how participants self-identified using DSMS and SMMS strategies while reading from an e-textbook**.** Following the trend of no significant difference, within groups statistics reported that there was no significant difference $F(1, 18) = .68$, $p = .798$ on how participants thought about DSMS and SMMS over time. There was also no significant difference $F(1, 18) = .013$, $p = .910$ over time depending on group usage of DSMS an DSMS strategies over time. Data also showed that there was no significant difference $F(1, 18) = .987$, $p > .05$ among each groups metacognition self-assessment. Finally, there was no significant difference $F(1, 18) = .762$, $p > .05$ over time in how groups thought about their metacognition.

Table 6

Mixed-Analysis of Variance Descriptive Statistics of Metacognition (i-MARSI) Source

	Df	MS	F	P
Between Groups				
Group	1	1.106	.613	.444
Error	18	1.803		
Within Groups				
Time (Pre-Post)	1	.023	.068	.798
Time X Group	1	.005	.013	.910
Error	18	.344		
Strategy Type	1	4.771	17.578	.001
Strategy X Group	1	.268	.987	.334
Time X Strategy X Group	1	.084	.762	.394
Error	18	.111		

Although data reported that there were no astounding differences in the way student participants metacognitively interacted with e-textbook features, research sub-question b will provide student explanations and first-hand accounts about specific features of the e-textbook they believed supported their comprehension. Focus groups were conducted to address the final question presented in this study.

Research sub-question b: What features of the e-textbook support student comprehension?

After participants completed a 20-item post-test, I placed student participants into groups based on comprehension growth. I based the rationale for the groupings on the desire to determine if differences existed in the usage of features and strategies based on the participants' comprehension gains/level, thus I used a multistage purposeful random sample in the study. Collins (2010) defines a multistage purposeful random sample was "choosing settings, groups, and/or individuals representing a sample in two or more stages. The first stage involves random selection and the following stages use purposive selection of participants." The participants for the focus group represent a purposive sample as they were selected and grouped based on the score received on their post content test. Initially, grouping was based on whether participant scores increased, decreased or stayed the same; however, the groups had to be modified as the majority of participants' comprehension scores improved. After the modification, the groupings were recast into a group that increased by five (I > 5), that increased less than five (I < 5), that stayed the same (STS), and that decreased (D) to capture and understand the experiences and preferences of all students. Once the participants were in their designated groups, they participated in focus groups and were asked a total of nine identical questions about their interactions with the physical science e-textbook. To analyze the focus groups, I used a combination of manual coding and Atlas.ti. I transcribed the data from each focus group interview, categorized by question and grouped into either decreased, increase, or stayed the same based on comparison of participants pre-and posttest scores. Based student participant pre and posttest scores, the aforementioned groups evolved into increase by five points, decreased by five points, stayed the same or decreased as students in the experimental group only increased their scores on the posttest. Once I categorized the data, I uploaded to Atlas.ti and read through several times. After three non-coding read throughs, I began to extract codes based on when the participant used their device and how they used the e-textbook features. These codes emerged into two of three prevalent themes presented in the data: feature and device usage. Sub-codes emerged under each over-arching theme to clarify how the device was being used and what particular features were used by the student participants.

Comprehension and e-textbooks. There was a consensus in each group that comprehension meant to simply understand. When the researcher probed the participants in efforts to expand their explanations, it was apparent that participants, regardless of groups, seemed to have a surface level understanding of what it meant to comprehend text. In an attempt to delve deeper into explaining the meaning of comprehension, in the group that increased by five points (I >5), a participant stated that "comprehension means to understand and be able to break down [anything] without any trouble." Further attempting to define comprehension, another participant added that comprehension meant, "reading well…basically understand[ing] the concepts of reading." In the group that increased less than five points (I < 5), participants unanimously agreed that comprehension simply meant to understand. Members in the group that stayed the same (STS) agreed that comprehension also meant understanding, but offered that it is also the ability to "tell others about it." Finally, participants in the group that decreased (D) determined that comprehension meant to "understand things," but added the importance of using context clues to assist in successful comprehension. I asked participants to determine if there were differences in comprehending from an e-textbook vs. traditional textbook. The results suggested that overall, participants in all groups believed that comprehending from an e-textbook was different, and slightly easier than comprehending from a traditional textbook. In group I > 5 experimental, initially one participant believed that comprehending from an e-textbook was no different than comprehending from a traditional textbook. However, when asked to explain her rationale she decided that there was in fact a difference. She stated, “If you don’t understand something and you are reading from your iPad/e-textbook, you can search it and understand it more. [You] can also look up definitions to assist with comprehension.” When asked how this was different than reading from a traditional textbook, the participant went on to explain the quick convenience that e-textbooks offer vs. a traditional textbook. Participants in I < 5 offered that reading from an e-textbook was easier than reading from a traditional textbook due to kinesthetic reasons. Participants’ enjoyed the ease in which holding the e-textbook/iPad offered. Participants in group D offered mixed beliefs on comprehending from an e-textbook. In total, all groups determined that reading from an e-textbook vs. traditional textbook was different, but was not necessarily easier. Although some participants appreciated features like highlighting and the zoom-in/out capabilities, they cited comprehension was sometimes difficult due to because it was difficult to read the words on the screen because of medical vision impairment issues.

Reading strategy usage. Since participants were instructed either to connect reading comprehension strategies (i.e. summarization and question generation) to e-textbook features (i.e. highlight, post-it notes, strikeout) or were solely instructed on the application of comprehension strategies, I wanted to gather an understanding of participants’ thoughts and prior experiences with using reading strategies to aid in comprehension of informational textbooks.

Many participants who received the experimental treatment and scored in the I > 5 group cited that they did not use strategies. One participant in the I > 5 experimental group noted that she only highlights definitions as a reading strategy. Another participant in the same group expressed that she has more success remembering content if she takes notes while reading. She expressed that if she depended on highlighting, she would likely not remember the content. In the same group a participant noted that she used rereading as a strategy to understand text. She stated “the more you read and like when you paraphrase it (understanding) comes easier.” Within the I < 5 experimental group, all participants expressed the importance of using strategies while reading. Noted reading comprehension strategies included the importance of understanding each section before moving onto the next section in the assigned reading, rereading sections to obtain the overall gist in content, taking notes, and asking internal questions about text to check comprehension. One participant stated, “I ask myself questions about the text and look to find the answers while I’m reading.” In the same group, one participant noted the differentiation of strategy usage from traditional textbooks and e-textbooks. She stated, “With an e-textbook it’s different than reading from a regular book. Sometimes you have to read and reread….and it will better help you understand.” A participant in the STS experimental group said that she did not use strategies while reading. Half the participants indicated that they did not use strategies, while the other half indicated that they used note-taking, high-lighting, and underlining as comprehension strategies; however, they indicated that these strategies were used with a traditional textbook and not the e-textbook.

Participants in group I > 5 comparison group indicated the usage of a self-produced reading strategy entitled “fish-tail.” The participant explained that by drawing the shape of a fish in the middle of the book, she gathered the most important words. Participants in the I < 5 comparison group added that they use rereading as a reading comprehension strategy and that they highlight important information while reading. Participants in the D comparison group expressed that they used context clues, highlighting, and parentheses as reading strategies. Unfamiliar with parentheses as a reading strategy, I asked for further explanation and a participant offered the following:

> Well the main that words that stands out. Our teacher gave us an assignment to put something in parentheses or highlight what's more important to you or what you feel best describes your answer for the question that she is giving us. So yeah, I put parentheses around that or highlight than to continue to go down the rest of the passage.

No participants tested into the STE (stayed the same) comparison group based on unchanged pre and post content comprehension scores.

Feature familiarity. In efforts to determine participants' prior exposure to features of the e-textbooks a series of questions were asked about feature usage, instruction, and reading impact. In the I > 5 experimental group, participants explained that they knew about the features, but were unsure how to access the features as there were multiple programs installed onto the iPad to access the physical science e-textbook. All participants in I < 5 experimental group noted that they had no prior experience or exposure to features of the e-textbook. A participant in the STS experimental group explained that she was very familiar with features of the e-textbook, but could not name specific features that she had interacted with prior to the study. Participants in I > 5 comparison group expressed that initially they were not familiar with features, but that they stumbled upon the features while reading leisurely and interacting with the iPad. In I < 5 comparison group, participants noted that they had minimal familiarity with the features of the e-textbook, but knew about the ability to highlight and define words while reading. Mixed results in the D comparison group indicated that some knew about the features and others did not. Participants that indicated knowledge of features explained that they knew minimally about the define feature, but not about highlighting or note-taking. No participants tested into the STS comparison group.

Although some participants indicated that they had no prior experience with features, it was still important to gain insight on the participants that did have prior experience and/or instruction of e-textbook feature usage. Participants in I > 5 experimental group indicated that although they had some experience with e-textbook features, they had never received direct instruction on using the features. Following the theme of non-instruction, I < 5 experimental group indicated that prior to the experiment, they received no instruction on how to explicitly use the features of the e-textbook. Differing from both experimental groups, an STS experimental participant credited her high school English teacher for providing direct instruction on e-textbook features; however, when asked about the specific instruction provided, the participant could only mention the usage of being directed to Spark Notes by her English teacher. The I > 5 comparison group specified that they were also not provided with direct instruction of e-textbook features. A participant went on to explain why she thought instruction did not happen: "Some of the teachers are older and they don't understand technology…we help them with technology." The I < 5 comparison participants indicated that they received instruction from their English teacher and school librarian. They indicated that their English teacher taught them how to use the highlight feature and the school librarian taught them how to download the book, which technically is not a feature. Participants in the D comparison group asserted that their English teacher did a thorough job at teaching them how to use features of the e-textbook; however, participants seemed focus on how the instruction was given and not necessarily on the content included in the instruction as they were not able to articulate specific features that they understood how to use.

Finally, I asked participants about the perceived impact that strategies had on their comprehension of the physical science e-textbook material. Participants in the I > 5 experimental explained how having knowledge of the features assisted in their attention span during lecture. Unanimously, participants agreed that “when the teacher goes over notes, some people stopped paying attention, but when we had to highlight things in the books, people paid more attention.” The I < 5 experimental group participants believed their comprehension was also impacted in a positive way. A participant explained that reading from an e-textbook was easier than reading from a traditional textbook. She stated, “I’m bad about losing notes, and I misplace it. It’s easier on the e-textbook cause you can go back to what you read and see what you highlighted and the note you put to the side.” Participants in the group agreed that having all their material in one place was useful. In the STS experimental group, one participant revealed that she felt that knowing the e-textbook features had a small impact on her understanding, but did not offer insight to her beliefs. To reiterate, participants in the comparison group were not provided with explicit instruction on the marriage of e-textbook features and comprehension strategies; rather, solely comprehension strategies. Although instruction was not provided, the teacher still modeled using the features during classroom instruction. The I > 5 comparison group participants offered that knowing and applying the strategies aid in their comprehension. The I < 5 comparison group participants noted that knowing the strategies helped, but did not offer further insight as to why they thought these strategies were helpful. The D comparison group participants believed that the strategies helped in increasing their learning, and wondered what impact would learning the features would have on their reading process.

Beneficial e-textbook features. A popular e-textbook feature that students felt most comfortable with and believed was most effective in efforts to achieve comprehension was the highlight feature. Participants in the I > 5 and I < 5 experimental groups, and the I < 5 and D comparison groups articulated that the highlight feature was the most effective in aiding comprehension of physical science material. Note-taking came in a strong second place as all participants in all experimental groups (i.e I > 5, I < 5, and STS) mentioned this as a helpful feature on the path of understanding. Participants in the comparison group did not mention note-taking as an effective strategy or feature. Honorable mentions included the define feature and the ability to increase and decrease content presented in the e-textbook. Participants in the D comparison group mentioned the appeal of copy and paste, which could still be considered note-taking as participants would paste content into electronic post-its within the e-textbook.

Summary

The teacher interview revealed that there was some hesitancy to use e-textbooks in class due to the numbers of students who did not have access; therefore, students had not created a habit of bringing their devices to class. The need for a participant observer was necessary due to the participant teacher's lack of knowledge on teaching comprehension strategies and reluctance in using the e-textbook as a supplant for the classroom textbook. Although 95% of students revealed in the initial e-textbook knowledge survey that they had prior experience using an e-textbook, and 81% indicated an awareness of features built into an e-textbook, focus groups indicated that participants had a lack of knowledge about the available features. While 59% of participants indicated that they had received instruction on comprehension strategies and e-textbook features, the *i*-MARSI scores confirmed that participants, regardless of grouping, did in fact have some exposure to metacognitive strategies in connection to the device.

Quantitative data determined that there was a difference in comprehension over time between the experimental and comparison groups, even though the observation protocol revealed a lack of iPad or e-textbook presence during class for the experimental group. Although I instructed and showed participants how to apply metacognitive strategies with their e-textbooks while reading, data shows that participants in both the experimental and comparison groups usage of SMMS and DSMS strategies neither increased nor declined. Focus groups interviews and observation protocols confirm that participants in both groups lacked the knowledge of using strategies prior to the study and rarely solely applied strategies like question generation and summarization while reading from an e-textbook without teacher modeling.

Chapter 5: Discussion

Introduction

The purpose of this explanatory sequential mixed method study was to investigate the effect of providing direct instruction to high school students on the connection of e-textbook features and pre-existing comprehension strategies, and how providing this instruction could potentially impact student comprehension of an e-textbook. The experimental group received strategy and feature connection instruction, while the comparison group only received comprehension strategy instruction. The criteria to participate in this study were possession of a school administered iPad and access to the physical science e-textbook. This chapter will discuss major findings and implications, followed by my recommendations for future research based upon the findings and implications.

Research Questions

1. How does direct instruction on the connection of comprehension strategies and features of the e-textbook in a public high school science class impact student comprehension?

   a. How are students metacognitively using features of the e-textbook?

   b. What features of the e-textbook support student comprehension?

Summary of Findings

Research Question One: The data collected indicated that there was a significant difference in comprehension growth in participants who received comprehension strategy and feature instruction versus participants who only received comprehension strategy instruction while reading from an e-textbook. The data collected to determine comprehension growth came from pre-and posttest material presented in chapter 10 of the physical science e-textbook. The experimental group showed a significant gain in comprehension, averaging a mean score of 6.63

on the pretest and 11.36 on the posttest. The comparison group's comprehension made a slight improvement, but in contrast to the treatment group, the improvement was not as great. Furthermore, although the experimental group increased in comprehension, the overall score was considerably low out of a 20-point test.

Research sub-question a: Data collected determined that there was no significant difference in metacognition amongst the experimental and comparison groups while reading from an e-textbook. The *i*-MARSI survey was used to determine how participants employed metacognitive strategies while reading from an e-textbook. The *i*-MARSI scale classified and reported the mean scores of the participants' strategy usage into Device Supported Metacognitive Strategies (DSMS) or Self-Monitoring Metacognitive Strategies (SMMS). Results for the experimental and comparison group showed no significant difference in contrast or improvement from the pre/post-test.

Research sub-question b: I conducted focus group interviews to determine what features participants believed supported their comprehension while reading from an e-textbook. Participants were grouped and interviewed based on score increase on the comprehension pre/post-test to determine if there was a difference in feature usage or support. Interview results suggested the top support e-textbook features were highlighting and note-taking. All experimental groups indicated that note-taking was a feature that assisted them in comprehension, while no groups from the comparison believed note-taking to be a helpful feature.

Conclusions

In this study, data revealed that comprehension was most impacted when student participants were provided direct instruction on strategy and e-textbook feature connection. To provide further insight on the overall results, I used four principles of Leu et al.'s (2013) new literacy theory as a framework to understand the impact that technology has on literacy. The principles are as followed: 1) The internet and related technologies require additional new literacies to fully access their potential. 2) New literacies are deictic. 3) New forms of strategic knowledge are required with new literacies, and 4) Teachers become more important, though their role changes with new literacy classrooms. The driving implication of this study is the importance of instruction on incorporating new technologies into the curriculum, but in order for a teacher to become proficient in providing meaningful instruction with new technologies, it is important that teachers are first given thorough professional development on how to integrate new technology tools into content and instruction. In turn, teachers will be able to provide concrete instruction and modeling for pupils.

Overwhelmingly, participants revealed during the focus group interviews that they were not provided instruction on the e-textbook capabilities and features. Participants in the experimental group stated, "Ain't nobody teach us, but you [me]." Also in the experimental group participants clarified, "They teach us how to download [the e-textbook], but as far as knowing you can do all different stuff, we never learned anything about that." Participants in the experimental group also added, "They teach you how to download, but never highlight, bold, nothing like you taught us." The participants who believed they had received instruction seemed to confuse strategy instruction with receiving instruction on how to use apps and/or online resources given by the teacher. One participant noted:

> Our English teacher taught us. Like when we are having trouble, she will give us stuff so we can go back on. Even when she isn't here, she will put up this website where we can

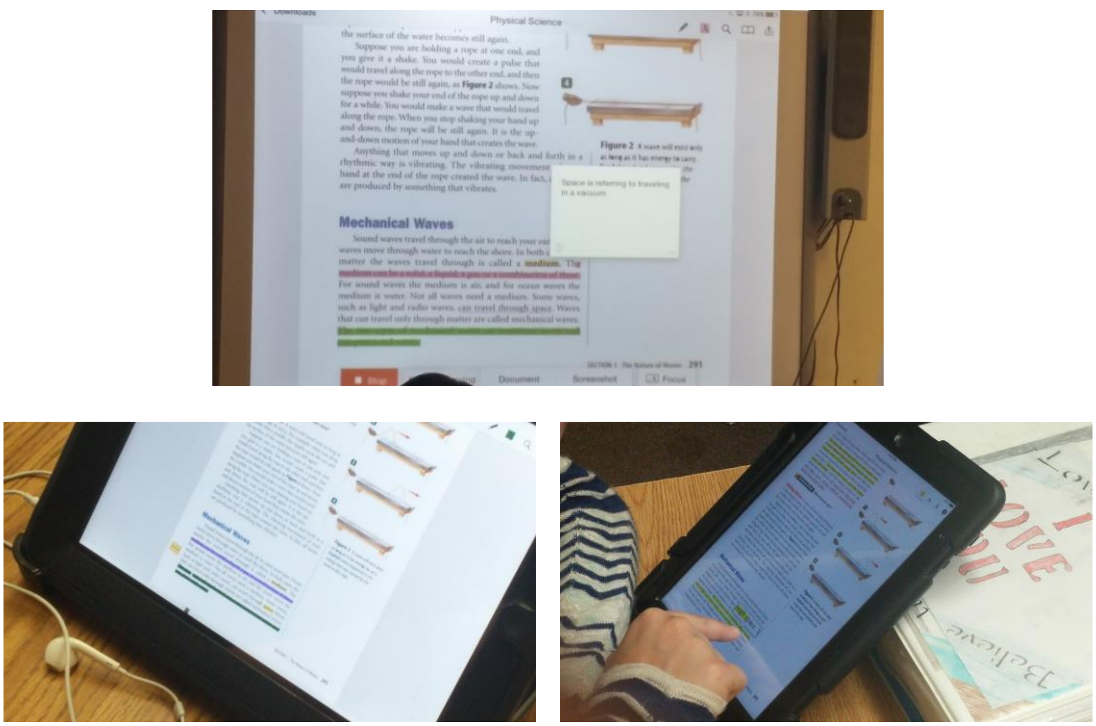
understand it better; Spark Notes or Weebley. It will show you how other people responded and how to understand it better.

Spark Notes is a website that provides study guides for literature, poetry, films and philosophy, and Weebly is a website that provides assistance in the form of webpage layouts and designs for its patrons to develop and operate their own sites. Although it is unclear what content the teacher placed on Weebly, it is important to note that neither Spark notes nor Weebly provides assistance with comprehension in the form of strategy instruction or e-textbook feature instruction. Thus, it is safe to conclude that the aforementioned student participant had not received prior feature instruction. Confirming my suspicion, the teacher participant revealed in his interview that the school had not offered any form of professional development about e-textbook integration, and integrating the e-textbook into instruction, because of this he decided to forgo providing instruction to his class after he received explicit instruction from me on comprehension strategies and e-textbook feature connection due to his discomfort or lack of knowledge.

Another important layer that promotes new literacies principle of the teacher's role is modeling (Leu et al., 2013). Data from the student survey indicated that 47% of students did not believe that their teacher modeled how to use features of the e-textbook. Modeling is a practice used to provide cognitive support to help students solve problems, and it has been used successfully in mathematics, science, writing, and reading comprehension (Rosenshine, 2012). Once I taught participants their respective interventions, both interventions were reinforced by teacher modeling. After I provided direct instruction in relation to each group intervention, the participating teacher modeled the strategies by using the think aloud approach. Think alouds allow the reader to verbalize and describe things they are doing to monitor their comprehension (Wade, 1990). In the experimental group, the teacher participant explained what strategy he applied to fix comprehension, what feature worked best with the selected strategy, and how to access the feature using the e-textbook. In the comparison group, his think alouds were almost identical to the experimental group, but he did not explain how to locate the features using the e-textbook. Although the act of modeling was not a focal point of this study, it was still an asset that propelled each intervention; however, teachers cannot model what they do not understand. Thus, professional development about technology integration is essential. During the study, there were multiple cases of participants in each group mimicking what they saw the teacher participant do with the features of the e-textbook. Images below display the teacher participant modeling feature usage and connecting those features to reading comprehension strategies, and two different students mimicking his technological behavior.

Figure 4

Monkey see, Monkey do: Teacher Modeling



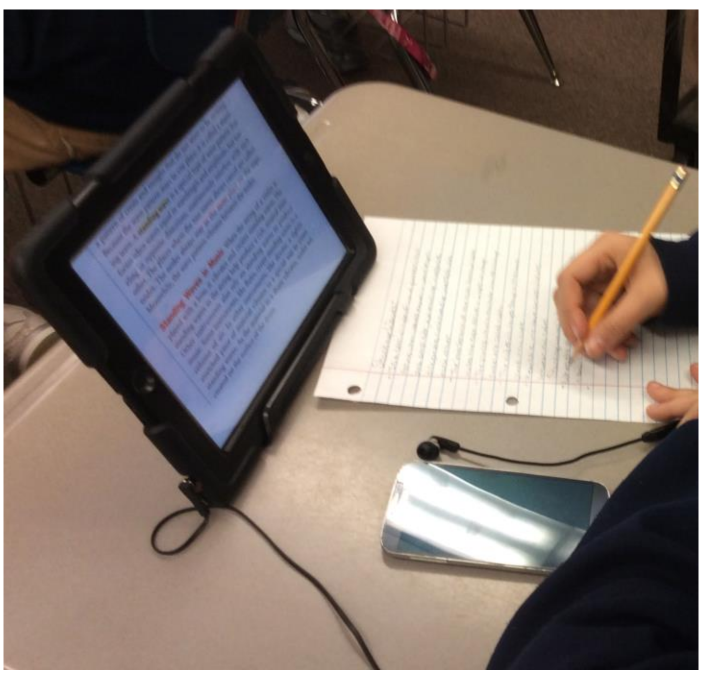
Although modeling happened in both groups, the experimental group advancement in comprehension was greater in comparison. While it appears that both participants are highlighting the same section as the participant teacher, what differs is the fact that the student participant on the left (experimental group) has also taken the extra step of annotating or providing additional notes from the lecture to further illuminate information in the highlighted section. This is shown by the small yellow sticky note box. The participant on the right (comparison group) has only chosen to use the highlight feature, and not annotate. From this, a conclusion that can be made is that modeling is ineffective if it is not preceded by direct instruction; thus the teacher's role is pivotal when transitioning to ICTs.

The second important New Literacy principle exemplified in this study is the importance of new forms of strategic knowledge. Data collected in the survey on student attitudes towards e-textbooks revealed that 75% of students used strategies while reading from an e-textbook; however, focus group interviews conflicted with the percentage of students that believed they used strategies or features while reading from an e-textbook. To date, studies done on e-textbooks are heavily concerned with student perception, likability, and comparison between traditional textbooks and e-textbooks, and there is a gap concerning the implementation of strategies or using features while reading from an e-textbook. This study explored the exploration of comprehension strategies and feature usage, which connects to the new literacy principle that concerns itself in devising new forms of strategic knowledge to achieve literacy when using new technologies. Although students seem to have knowledge on how to operate e-textbooks, there was an apparent lack of knowledge on how to access features and apply strategies. McFall (2005) asserted students, although aware of features, do not use many of the features designed to make them active readers. While survey data revealed that 81% of students knew about the e-textbook features, focus group interviews concluded that participants did not know how to access the features or know particular strategies to help propel the use of e-textbook features. There was a consensus among student participants about the lack of feature knowledge in the group that improved more than five points (I>5) on the posttest. A participant stated, “I didn’t know how to get to them [features], cause I didn’t use them.” Another student in the same group claimed, “I knew about them, I just didn’t know how to get to them because we rarely use our books in class.” Metacognition and self-regulation were evident in the student participants’ intentional usage of strategies or strategies and feature connection; however, the extent to which student participants revealed how they fell on the metacognitive scale, their use of either device support strategies or self-monitoring strategies is still uncertain. To gather data on metacognitive strategy usage while reading from an e-textbook, I explored the *i*-MARSI data. Data revealed that participants in both groups increased in self-monitoring metacognitive strategies (SMMS), 6 of 11 increased in the comparison group, and 7 of 9 increased in the experimental group. A conclusion that could be made about the increase in self-monitoring strategies is the existence of metacognitive strategies prior to the study. There is a chance that although I am unclear about the impact that instruction had on student’s DSMS and SMMS were impacted because of pre-established knowledge and use of strategies. Although students did not identify the metacognitive strategies taught (e.g. summarization, question generation) in the experiment as known strategies during focus group interviews or the e-textbook survey, there is a chance that students progressed to the automatic phases, and the strategies were no longer strategies, but rather, skills. The difference between a skill and a strategy is the automatic process from purposefully controlled process (Afflerbach et al., 2008). Participants in all groups received metacognitive strategy instruction and showed a difference in their reading habits, but those habits take more time and attention that can be given in a single semester course (McFall, 2005).

Participants in experimental and comparison groups determined that highlighting was the best feature to support their comprehension. Results from the *i*-MARSI support that students were comfortable with using device supported metacognitive strategies (DSMS). The experimental (M=3.48, M=3.35) and comparison (M=3.07, M=3.05) groups mean scores remained consistent at a medium average from the pre and post survey which indicated that students used device supported metacognitive strategies while reading from digital academic materials. Interestingly, only the experimental group added the importance of the note-taking feature to successfully comprehend their physical science e-textbook. A participant noted, "it's so much easier to take notes in the iPad because you can find everything in one place, and papers not get lost." Highlighting is a component of annotation and taking notes. Annotating helps readers engage with text and promotes active reading. Annotating establishes a "visible record" for the reader to reflect on thoughts that emerged while reading (Porter-O'Donnell, 2004). Although participants in both groups chose highlighting as the most effective feature, the experimental group possibly had more success with the highlighting feature because they were also taught how to connect highlighting and annotation while reading from an e-textbook. Participants in the comparison group only chose highlighting as a helpful feature, and neglected to mention note-taking, although they were taught strategies that would help to generate meaningful notes. An item on the *i*-MARSI asked how often students used the annotation feature to summarize recently read information. An item analysis indicated that 7 of 11 student participants occasionally used the annotation feature while reading electronically. Students in the comparison group were not provided with direct instruction about how to access the annotation feature of the e-textbook, but where given instruction about how to generate summaries and questions while reading from their physical science e-textbook. Focus groups interviews indicated that students gravitated to highlighting, but I would propose that students chose the highlighting tool because it is easy and required no cognitive or metacognitive action. It takes thought and an understanding of the material read to develop meaningful questions and generate summaries connected to the content. This complex cognitive and metacognitive behavior could have possibly detoured the students from using the annotation feature. Simply, students in the comparison group did not know what to write, leaving the annotation to be used occasionally. Another likely difference is the lack of connection between e-textbook features and the strategies. Since participants in the comparison group were not taught features, only 1 of 11 participants took it upon themselves to generate hard copy notes on loose leaf paper.

Figure 5

E-textbook and Printed Note-taking



Attendance played a huge part in student success. If a high school student missed class, as a former secondary teacher, I assumed that it was the student's responsibility to find time to recoup missing instruction. It is important to note that there was no "make-up" required for students that missed strategy instruction nor did the students that missed instruction seek out an alternative time. I determined that although attendance does factor into student comprehension success, it needed to be combined with device presence and academic interactions to potentially see positive effects. The results suggest that there could be a positive correlation between how students interact with their device and their comprehension success. The data examined determined that although attendance and possession of the iPad were important to student comprehension, inevitably successful comprehension is determined by student interaction with the device. Data showed that the comparison group bought their iPad to class more often than the experimental group, but since they did not receive instruction on how to operate the e-textbook for academic purposes, this could have potentially impacted their comprehension scores. On the other hand, the experimental group received the instruction, but barely bought their devices to class, so student participants in the experimental group did not use class time to implement, apply and practice the interventions while reading from an e-textbook.

Implications

In this study, the need for teacher professional development was a clear implication; however, education on e-textbook integration should begin in teacher education preparation and in administrative certification programs. Training would look different in both programs. Teacher education programs would facilitate how to teach teachers to teach students how to integrate e-textbook into the curriculum and content. Whereas, administrative programs would teach administrators how to coach teachers about the integration process. The following implications will conclude that e-textbook integration should be seen as a top-down, collaborative effort by all players in the field of education.

Higher Education

Researchers. Researchers are starting to pay close attention to e-textbook integration in education. As it stands, most research has been carried out in the higher education realm, and little in secondary education. The themes that arise in current research on e-textbooks are student attitudes and perception, e-textbook vs. printed textbook, student preference, and student learning. To date, there have been no research that explores the explicit instruction and intentional application of strategies and e-textbook features. Researchers need to fill in the gaps by expanding the experimental populations outside of higher education to k-12, since e-textbook integration will impact them as well. Researchers should explore the impact that providing professional development about learning how features help students use strategies for comprehension, and what that would look like in a professional setting. Finally, there are multiple styles of e-textbooks, and many studies are unclear about the type of e-textbook being used; therefore, to adequately measure comprehension gains, or replicate their studies, there needs to be a consistency in the definition of e-textbooks used in each study. Otherwise, it is unclear which feature of e-textbooks would be beneficial for students. In the search for a school that was using e-textbooks, it would be more useful to observe students that were using reflowable or enhanced e-textbooks rather than the static e-textbooks that were used in this study. As mentioned in chapter two, enhanced e-textbooks are interactive in a way that static e-textbooks are not. Enhanced e-textbooks offer the reader interactive media features (e.g. video, podcast, narration, hyperlinks, and device accessibility). Whereas, static e-textbooks are typically a pdf version of a printed textbook.

Higher education pre-service training professors. There is a need for pre-service teachers to have a working knowledge of how to integrate technology efficiently into their content before their practice begins. Research suggests there is not only a gap in the lack of quality professional development for practicing teachers, but also inadequate teacher preparation programs for pre-service teachers (Singer & Maher, 2007).

K-12 Education

Administrators. An administrator wears many hats, which makes this position extremely multi-faceted in education. In public education, an administrator is not only a shepherd for the many pupils that are matriculating 180 calendar days, but also a coach and instructional leader for the teachers. The administrator for this study's site was newly appointed and overwhelmed with restructuring how the site disseminated technological devices to students. The school was missing over half of its device inventory and was unable to provide a device for all students. However, this research revealed three things that affect an administrator's success in integrating e-textbooks into all content areas. The teacher participant revealed that he had not received professional development on e-textbook integration, and was unfamiliar with the features that were available until the researcher provided him with explicit instruction. Professional development is essentially informative pedagogical sessions that allow teachers to continue their education in a non-traditional setting. In some educational facilities, it is the job of the administrator to anticipate teachers' needs and seek out educators who can provide meaningful professional development for the practicing teacher. Research suggests that teachers who received professional development are more successful at implementing new instructional methods (Beglau et al., 2011). Therefore, if teachers are going to be successful at integrating e-textbooks into instruction, it is vital that administrators first prepare thorough and reoccurring professional development on the integration and content connection of e-textbooks. Second, an administrator must also work to establish a technological culture in the school for e-textbook integration to be successful. Since there was a deficit of devices at the site of the study, it was not a requirement to bring the iPad to class. However, if integration is to be successful, the administrator needs to change the culture within the school. This starts with requiring the use of e-textbooks in the classroom by all teachers; however, for this change to be successful, it must be supported at the building and district levels. Teachers must see the e-textbooks as replacements or supplants for hard copy textbooks, and administrators must show year-to-year consistency in making technological integration a focal point of the school's mission. Finally, schools must revise school-wide policies and funding to facilitate e-textbook integration.

There are multiple barriers connected to policy and funding that impeded a successful e-textbook integration. First, the no-book-bag policy effected students' usage of e-textbooks. Since there was not a culture established at the school for solely using e-textbooks, students made daily transitions from hard back textbooks to e-textbooks; therefore, some needed a book bag to hold all their school materials. Furthermore, some students chose to carry additional iPad accessories (e.g. keyboard, mouse, charging cords, headphones, etc.) for using the device and felt the discomfort of the no-book-bag policy, thus choosing to not bring their iPad to class. Finally, building environment was a big hindrance in integrating e-textbooks into the classroom. There were only three sockets which only allowed six participants to charge their iPads. Furthermore, the proximity of student seating and sockets was not conducive to the learning atmosphere. Prior to implementing e-textbooks, there is a lot of front work that must be done for implementation to be successful. It is the role of the administrator to ensure that teachers are provided professional development, work at establishing a school-wide technological culture, and revisit school policies, building environment and funding to insure successful integration.

*Practitioners***.** Once a culture has been established and teachers have been provided reoccurring, consistent professional development on the integration of e-textbooks, it is the teacher's responsibility to reinforce and integrate these lessons into instruction. This means that the teacher is using e-textbooks as a supplant and not a supplement. During this study, the teacher participant did not require his students to bring their iPads to class. Instead he offered the students to read from a printed classroom set of physical science textbooks when he assigned in class readings. He explained that he kept a classroom set of the science textbooks because all students did not have access to an e-textbook because they did not have a device, and students that had a device were not consistently bringing them to class. Further, he kept the classroom printed textbook because he spare iPads were taken to make up for the device deficit.

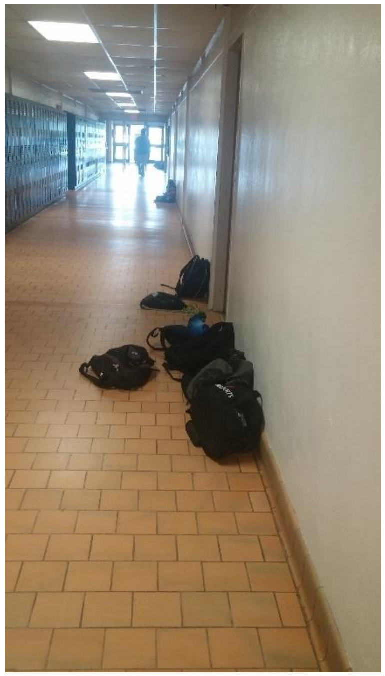
If a technological culture is established, it is up to the teacher to reinforce the culture by policing the presence of e-textbooks in the class and not presenting alternative options if the device is not on the students' person. In addition to perpetuating a technological culture, teachers must also believe or "buy-into" the idea of not only teaching their content, but teaching student how to operate and connect the e-textbook to the curriculum.

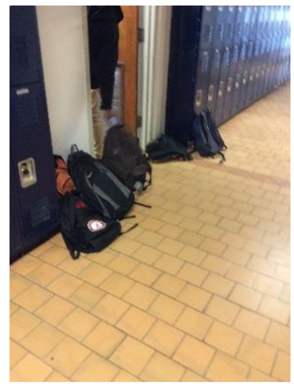
Limitations of the Study

Setting. The setting for this study was at a rural high school that was in the second year of implementation of the one-to-one technology initiative. Except for incoming ninth grade students who received Chromebooks, tenth through twelfth grade students received an iPad 2 or iPad 4 device with 16 gigabytes (GB). Although there was only a total of 22 participants in the study, there were 69 students in all three sections of the physical science course that potentially had access to a device. Student attendance was another issue that adversely impacted this study. I was only present in the school two to three times a week. Naturally, students were absent due to various reasons (e.g. sickness, extracurricular activities, in-house suspension, pregnancy, etc.), which affected the amount of time that participants had to practice with the group intervention. Furthermore, if participants missed out on teacher modeling and the ability to ask for clarification on any point of confusion in regards to the interventions provided, this could have impacted the overall results in this study. Another factor that limited the results was the school rules put in place. Often, participants did not have their devices present in class, perhaps because they forget the device or it was dead. A school rule that could unknowingly influence the device presence in class is the “no book bag” rule. Per the school’s policy, students were not allowed to carry books bags throughout the day; rather, they had to leave them in their assigned locker. This rule could have reduced the number of iPads present in class because participants did not want to tote around a lot of objects from class to class, as well as, the necessary accessories (e.g. charger, detachable keypad, mouse, etc.) to comfortably operate an iPad. The image below provides evidence of student repercussions for bringing books bags to class.

Figure 6

The lonely hallway book bags





Although the school implemented the one-to-one technology initiative for all students, many teachers were noncompliant and forbade students to operate or bring devices to class because of personal discomfort and knowledge with integrating the technology into the curriculum. If a student bought the iPad to class they would potentially have to leave the iPad in their book bag, leaving them susceptible to theft as the campus was open, and book bags were left unattended in the hallway while the windowless classroom doors remained locked for safety.

Another issue with the setting of the site was the infrastructure and building environment. The school was only in its second year of technology implementation, but it was obvious that the school was ill-equipped to handle the needs of the electronic devices. There were three sockets in the entire classroom, with the ability to plug in two electronic items, which resulting in only six available charging stations. This low number left many students without a place to charge their devices. Furthermore, the proximity in which the sockets were placed affected the participant’s interactions and engagement with the devices, as many participants charging cords were not long enough, leaving them unable to engage with their device while charging. Moreover, students could interact with their cell-phones during class time, and some students would use the sockets to charge their phones instead of their iPad or both simultaneously. The figures below not only show the space from the student and device charging, but also the limited amount of charging stations.

Figure 7

So Close, Yet so Far Away

Sample. Initially, there were 24 participants in this study; however, only 22 completed the study, which left the statistical power low. Greater statistical significance could have been possible if there were a larger number of students participating in the study. Multiple efforts were made by the researcher and participating teacher to recruit students; however, many students did not meet the criteria to participate in the research study.

Instruments. The *i*-MARSI and the e-textbook survey instruments used in this study relied on the participants to self-report. These instruments are considered limitations because the researcher had to rely on participants' honesty, introspection, understanding of survey items, and bias about the subject matter presented in each survey.

Device. Although the site was in its second year of the one-to-one technology initiative, it appeared that the school had already lost about half of their technology equipment. According to the school principal and librarian, 900 iPads were disseminated the first year of the program; however, at the end of the year the school only received 400 iPads returned from the student population. The new administrator of the school explained that the first year, which was not under his tenure, encountered many difficulties. There was speculation of high occurrences of theft from internal and external sources, pawning the devices, and broken equipment. He went on to explain that there were no proactive measures put in place such as labeling, tracking, and student contracts during the first year of implementation, about which he was planning to change. The deficit of school-wide iPads left many students without technology, forcing many teachers to return back to a non-digital format of providing instruction. Instead of using the iPad and e-textbook as a supplant, it was now either used as a supplement or not at all.

Another implication of the technological devices was the availability of the school's wifi. Many students who had an iPad did not know the code to log onto the school's wi-fi, which put them at a disadvantage from using all available e-textbook features, such as define or search options. Students were also reluctant to use the e-textbook for reading purposes because of the inconsistent availability of the wi-fi.

E-textbook type. The e-textbook used in this study was considered a static e-textbook. Typically, static e-textbooks are pdf versions of an e-textbook. Chesser referred to static e-textbooks as page-fidelity. Page-fidelity e-textbooks keep the layout of the print version of the e-textbook and are usually built from a pdf source (2011). Chesser (2011) stated, "majority of e-textbook products available to students today are derived from a print product" (p. 32). Reflowable textbooks allow a more interactive experience for the reader. These e-textbooks allow the reader to customize their reading experience by adjusting font sizes and adjust windows without disturbing the size of the page. Reflowable e-textbooks are usually created using extensible markup language (XML) source file. However, Chesser (2011) noted that schools typically gravitate towards page-fidelity e-textbook because it is more cost-effective than purchasing reflowable e-textbooks which are costly.

Finally, the financial responsibility of maintaining and caring for the device might be insurmountable for the students and their families. Technically, the site was not considered a Title 1 school; however, the guidance counselor, explained that the school does qualify for Title 1 funds, but the students and families fail to return the proper paperwork in order for the school to receive funding. Figure five provides a list of all cost associated with technology for grades 10-12.

Figure 8

It Costs: Replacement Cost for Technology

Cost for IPad Air and Accessories (10th-12th)

Annual Rental fee- $30.00 (Must be paid before student receives device)
IPad 2 GB Wi-Fi- $499.99
IPad 4 16 GB Wi-Fi- $499.99
Apple 12W USB Power Supply- $200.00
Apple Lightning to USB cable (1m) - $20.00
Griffin Survivor: iPad Air case- $31.06
Griffin Survivor: stand- $3.41
Green Gumdrop Case- $75.00
Otterbox Complete Cover- $80.00
Otterbox Stand- $40.00
Cracked Screen- $30.00

Cost for the Chromebook (9th Grade Only)

Annual Rental Fee- $30.00 (Must be paid before student receives device)
Replace Damaged Chromebook- $279.00
Replacing Screen- $90.00
Replacing Keyboard/touchpad- $52.00
Replacing Power cord- $32.00

Treatment time. Although the study schedule indicates a time span of an 11-week period, there were a lot of complications that arose during this time, which disrupted the experimental and comparison group interventions. On top of student absences and researcher availability, there were multiple days allotted for observing holidays, school functions, and a week-long spring break. Furthermore, in efforts to play catch up with the curriculum, there were a few days that the participant teacher requested my absence. Naturally, I respectfully complied; however, there was no way to determine if the participant teacher was reinforcing the intervention for both groups via modeling or even if the students were interacting with the e-textbook. This dead time could adversely affect the strength of the treatment for the participants.

Teaching experience. The participant teacher was unfamiliar with providing explicit instruction on comprehension strategies and e-textbook features. This insufficiency led him to request collaboration between us. The participant teacher expressed a higher level of comfort if the researcher taught the designated intervention to the experimental and comparison group, and would rather reinforce the instruction by modeling the use of intervention. Adding to the discomfort of delivering new instruction, the participant teacher was also not a certified teacher; rather, he had been teaching on an emergency certification for two years. The novelty of his instruction and modeling as reinforcement could potentially skew the effectiveness of the interventions.

Recommendations

The scarcity of research on e-textbooks, direct instruction, and secondary education provides an opportunity to expand upon this high priority area of scholarship. With the potential proliferation of e-textbooks in all classrooms by 2017 and the demand to make students technologically competent, it has become increasingly important that researchers become more inclusive of the types of populations being studied. As high school teachers work to close the achievement gap, they are also being tasked to incorporate new technologies into daily instruction without the proper training. Thus in order to study the effects of e-textbooks, future researchers should consider studying at a school that has already established a technological culture. This would limit the amount of hours spent policing students to bring and use devices during class time. Working with a site that uses e-textbooks as a supplant and not a supplement would also allow the researcher to acquire more time observing students practice with specific interventions. Along with working in a school with an established technological culture, it is imperative that the school's infrastructure support the use of e-textbooks. If student's devices are dead, this impedes the observations of student interactions with the device and student learning.

The usage of metacognitive strategies was measured throughout this study. Although the I attended class for 11 weeks to assess and observe the use of learned metacognitive strategies in connection to e-textbook features, there is a possibility that a future researcher would need to spend a full school year, starting at the beginning of the semester to truly gauge how students were using metacognitive strategies to support navigating the e-textbook features. Furthermore, to measure the effects of both dependent variables (e.g., device supported or self-monitoring) a researcher should be concerned with gathering a larger population and using a multivariate analysis (MANOVA) to determine growth over time of either metacognitive strategy.

The final recommendation for future researchers is the need to streamline the style of e-textbook being studied. I encountered difficulties finding a school that used enhanced e-textbooks that incorporate active hyperlinks, audio, and interactive visuals, etc., rather than the static e-textbook used in this study. It is unclear how the different styles of e-textbooks impact student comprehension, if there is a difference in how students engage with the different styles of e-textbooks, and which style of e-textbook is easier to connect to strategies and features verses a static textbook that is simply displayed digitally with limited interactions.

Final Conclusion

This study provided insight on the impact that providing direct instruction on the connection of comprehension strategies and e-textbook features had on secondary students' comprehension. The study revealed that direct instruction is a useful tool when integrating e-textbooks into the classroom. Furthermore, the results called attention to the need to not only adequately prepare pre-service teachers in teacher preparation programs to gain experience and comfortability with integrating technology into instruction, but also the need for professional development for practicing teachers to acquire working knowledge of integrating e-textbooks into instruction. Although students were using metacognitive strategies in this study, it is important to understand how features of the e-textbook support student learning in order for them to become more strategic while engaging digitally with text. Finally, although students unequivocally believed that highlighting was an effective feature that aided in student comprehension, it important to understand that students who had a purpose and a strategy to support the feature of highlighting text with annotation performed better on comprehension tests. Therefore, it can be concluded that a connecting reading comprehension strategies to features of the e-textbook is beneficial for secondary learners.

References

Afflerbach, P., Pearson, P. D., & Paris, S. G. (2008). Clarifying differences between reading skills and reading strategies. *The Reading Teacher*, *61*(5), 364-373.

Archer, A., & Hughes, C. A. (2011). Explicit instruction: Efficient and effective teaching. *New York, NY: Guilford Publications*.

Avila, J., & Moore, M. (2012). Critical literacy, digital literacies, and common core state standards: A workable union?. *Theory Into Practice*, *51*(1), 27-33.

Baker, L. (1991). Metacognition, reading and science education. *Science Learning: Processes and Applications*, 2-13.

Baker, L. (2002). Metacognition in comprehension instruction. *Comprehension Instruction: Research-Based Best Practices*, 77-95. Baker, L., & Brown, A. L. (1984). Metacognitive skills and reading. In P. D. Pearson, R. Barr, M. L . Kamil, & P. Mosenthal (Eds.), *Handbook of Reading Research* (pp. 353–394). New York: Longman.

Beglau, M., Craig-Hare, J., Foltos, L., Gann, K., James, J., Jobe, H., & Smith, B. (2011). Technology, coaching, and community: Power partners for improved professional development in primary and secondary education. *Washington DC: ISTE*.

Bernhardt, E., Destino, T, Kamil, M., & Rodriguez-Munoz, M. (1995). Assessing science knowledge in an English/Spanish bilingual elementary school. *Cognosos*, 4,4-6.

Borkowski, J. G., Carr, M., & Pressley, M. (1987). "Spontaneous" strategy use: Perspectives from metacognitive theory. *Intelligence*, *11*(1), 61-75.

Brown, A. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanism. In F. Weinert & R. Kluwe (Eds.*), Metacognition, Motivation, and Understanding* (pp. 65-116). Hillsdale, MJ. Erlbaum.

Byun, H. S., Choi, J. I., & Song, J. S. (2006). The research on the prototype development of digital textbook. *Journal Instructional Technology Research*, *22*(4), 217-24.

Castek, J. (2008). How do 4th and 5th grade students acquire the new literacies of online reading comprehension. *Exploring the contexts that facilitate learning*.

Cardullo, V., Wang, S., Wilson, N., & Zygouris-Coe, V. (Under review). *i*-MARSI *iPad Metacognitive Awareness of Reading Strategies Inventory*: Using an Inventory to Survey Students Cognitive Monitoring of Strategies. *Journal of Educational Psychology*.

Carnine, D. (2000). Why Education Experts Resist Effective Practices (And What It Would Take To Make Education More Like Medicine).

Carnine, L. & Carnine, D. 2004. The interaction of reading skills and science content knowledge when teaching struggling secondary students. *Reading & Writing Quarterly*, 20, 203-218

Chesser, W. D. (2011). The e-textbook revolution. *Library Technology Reports*, *47*(8), 28-40.

Coiro, J. (2003). Reading comprehension on the Internet. Expanding our understanding of reading comprehension to encompass new literacies. *The Reading Teacher*, *56*(5), 458-464.

Collins, K (2010). Advanced sampling in mixed method research. In A. Tashakkori & C. Teddlie (EDs) Mixed Method in social and behavioral research. Sage.

Craig, M. T., & Yore, L. D. (1995). Middle school students' metacognitive knowledge about science reading and science text: and interview study. R*eading Psychology: An International Quarterly*, *16*(2), 169-213.

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Cubukcu, F. (2008). Enhancing vocabulary development and reading comprehension through metacognitive strategies. *Issues in Educational Research*, *18*(1), 1-11.

Daniels, H. (2001) *Vygotsky and Pedagogy*. NY: Routledge/Falmer.

Daniel, D. B., & Woody, W. D. (2013). E-textbooks at what cost? Performance and use of electronic v. print texts. *Computers & Education*, *62*, 18-23.

Davey, B., & McBride, S. (1986). Generating self-questions after reading: A comprehension assist for elementary students. *The Journal of Educational Research*, *80*(1), 43-46.

Deshler, D. D. (2005). Adolescents with learning disabilities: Unique challenges and reasons for hope. *Learning Disability Quarterly*, *28*(2), 122-124.

Dobler, E. (2015). e-Textbooks. *Journal of Adolescent & Adult Literacy*, *58*(6), 482-491.

Dobler, E. (2016, January 19). Personal interview.

Dole, J. A., Brown, K. J., & Trathen, W. (1996). The effects of strategy instruction on the comprehension performance of at-risk students. *Reading research quarterly*, *31*(1), 62-88.

Dole, J. A., Nokes, J. D., & Drits, D. (2009). 16 Cognitive strategy instruction. *Handbook of Research on Reading Comprehension*, 347.

Duke, N. K. (2000a). 3.6 minutes per day: The scarcity of informational texts in first grade. Reading Research Quarterly, 35, 202–224

Duke, N. K., & Bennett-Armistead, V. S. (2003). *Reading & writing informational text in the primary grades*. Scholastic Teaching Resources.

Duke, N. K. (2004). The case for informational text. *Educational Leadership*,*61*(6), 40-45.

Durkin, D. (1978). What classroom observations reveal about reading comprehension instruction. *Reading Research Quarterly*, 481-533.

Durkin, D. (1993). *Teaching them to read*. Allyn and Bacon, Order Processing, PO Box 11071, Des Moines, IA 50336-1071.

Eker, C. (2014). The effect of teaching practice conducted by using metacognition strategies on students' reading comprehension skills. *International Online Journal of Educational Sciences*, *6*(2), 269-280.

Fang, Z., Lamme, L., Pringle, R., Patrick, J., Sanders, J., Zmach, C., Henkel, M. (2008). Integrating reading into middle school science: What we did, found and learned. *International Journal of Science Education*, 30, 2067-2089.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. *The nature of intelligence, 12*, 231-235.

Gersten, R., & Carnine, D. (1986). Direct Instruction in Reading Comprehension. *Educational Leadership, 43*(7), 70-78.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and special education*, *7*(1), 6-10.

Greene, J. C., Caracelli, V. J., & Graham, W. F. (1989). Toward a conceptual framework for mixed-method evaluation designs. *Educational evaluation and policy analysis*, *11*(3), 255-274.

Griffith, P. L., & Ruan, J. (2005). What is metacognition and what should be its role in literacy instruction. *Metacognition in literacy learning: Theory, assessment, instruction, and professional development*, 3-18.

Grimshaw, S., Dungworth, N., McKnight, C., & Morris, A. (2007). Electronic books: Children's reading and comprehension. *British Journal of Educational Technology*, *38*(4), 583-599.

Grudzien, P., & Casey, A. M. (2008). Do off-campus students use e-books?. *Journal of Library Administration*, *48*(3-4), 455-466.

Guess, A. (2008, January 3). E-Textbooks -- for Real This Time?. Inside Higher Ed. Retrieved December 3, 2015, from https://www.insidehighered.com/news/2008/01/03/ebooks.

Hacker, D. J. (1998). Definitions and empirical foundations. *Metacognition in Educational Theory and Practice*, *14*, 1-23.

Hammond, J. (Ed.) (2002) Scaffolding Teaching and learning in language and literacy education. Newtown, Australia: PETA.

Henry, L. (2006). SEARCHing for an answer. The critical role of new literacies while reading on the Internet. *The Reading Teacher*, 59(7), 614-627. doi: 10.1598/RT. 59.7.1

Hidi, S., & Anderson, V. (1986). Producing written summaries: Task demands, cognitive operations, and implications for instruction. *Review of Educational Research*, *56*(4), 473-493.

Hohmann, A. A., & Shear, M. K. (2002). Community-based intervention research: Coping with the "noise" of real life in study design. *American Journal of Psychiatry*, *159*(2), 201-207.

International Reading Association. (2009). New Literacies and 21st century technologies (Position Statement). Newark, DE: Author. Available from: www.reading.org/General/AboutIRA/PositionStatement/21stCenturyLiteracies.aspx

Israel, S. (2005). *Metacognition in literacy learning theory, assessment, instruction, and professional development*. Mahwah, N.J.: L. Erlbaum Associates.

Jacobs, J. E., & Paris, S. G. (1987). Children's metacognition about reading: Issues in the definition, measurement, and instruction. *Educational Psychologist*, *22*, 255–278.

Jones, T., & Brown, C. (2011). Reading Engagement: A Comparison between E-Books and Traditional Print Books in an Elementary Classroom. *Online Submission*, *4*(2), 5-22.

Kim, J. H. Y., & Jung, H. Y. (2010). South Korean digital textbook project. *Computers in the Schools*, *27*(3-4), 247-265.

Kinniburgh, L. H., & Shaw, E. L. (2009). Using question-answer relationships to build: Reading comprehension in science. *Science Activities: Classroom Projects and Curriculum Ideas*, *45*(4), 19-28.

Kintsch, W., & Van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Psychological Review*, *85*(5), 363.

Klein, A. (2015, April 10). No child left behind overview: Definitions, requirements, criticisms, and more. Retrieved September 06, 2016, from http://www.edweek.org/ew/section/multimedia/no-child-left-behind-overview-definition-summary.html Korat, O. (2010). Reading electronic books as a support for vocabulary, story comprehension and word reading in kindergarten and first grade. *Computers & Education*, *55*(1), 24-31.

Krause, K., Bochner, S. & Duchesne, S. (2003) Educational Psychology for Learning and Teaching. Australia: Thomson

Lankshear, C., & Knobel, M. (2006). Digital literacy and digital literacies. *Nordic Journal of digital literacy*, *1*(1), 12-24.

Lawless, K. A., Mills, R., & Brown, S. W. (2002). Children's hypertext navigation strategies. *Journal of Research on Technology in Education*,*34*(3), 274-284.

Lawrence, D. (2015). Why use Question-Answer Relationships (QAR) as a comprehension strategy?. *Literacy Learning: The Middle Years*, *23*(1), i-vii.

Lee, H. J., Messom, C., & Yau, K. L. A. (2013). Can an Electronic Textbooks Be Part of K-12 Education?: Challenges, Technological Solutions and Open Issues. *Turkish Online Journal of Educational Technology-TOJET*, *12*(1), 32-44.

Leopold, C., Sumfleth, E., & Leutner, D. (2013). Learning with summaries: Effects of representation mode and type of learning activity on comprehension and transfer. *Learning and Instruction*, *27*, 40-49.

Leu, D.J. Jr. (1997). Caity's question: Literacy as deixis on the Internet. The Reading Teacher, 51(1), 62-67.

Leu, D. J. (2000). Literacy and technology: Deictic consequence/s for literacy education in an information age. In M.L. Kamil, P. Mosenthal, P.D. Pearson, & R. Barr (Eds.), Handbook of reading research (Vol. 3, pp. 743-770). Mahwah, NJ: Erlbaum.

Leu, D. J., Kinzer, C. K., Coiro, J., Castek, J., & Henry, L. A. (2013). New literacies: A dual level theory of the changing nature of literacy, instruction, and assessment. *Theoretical Models and Processes of Reading*, *6*, 1150-1181.

Leu, D.J., Coiro, J., Castek, J., Hartman, D., Henry, L.A., & Reinking, D. (2008). Research on instruction and assessment in the new literacies of online reading comprehension. In C. C. Block & S. Parris (Eds.), Comprehension Instruction: Research-based best practices (pp. 321-345). New York: Guilford.

Lewis, C., Fabos, B. (2005). Instant messaging, literacies, and social indemnities. *Reading Research Quarterly*, *40*(4), 470-501.

Liebfreund, M., & Conradi, K. (2016). Component skills affecting elementary students' informational text comprehension. *Reading & Writing*, *29*(6), 1141-1160. doi:10.1007/s11145-016-9629-9

Livingston, J. A. (2006). Metacognition: an overview. 1997. *Download: http://www. gse. buffalo*.

Massey, D. D. (2009). 18 Self-Regulated Comprehension. *Handbook of Research on Reading Comprehension*, 389.

Magaldi, L. G. (2010). Metacognitive strategies based instruction to support learner autonomy in language learning. *Revista Canaria de Estudios Ingleses*, 6173-86.

Maloch, B., & Bomer, R. (2013). Informational texts and the Common Core Standards: What are we talking about, anyway?. *Language Arts*, *90*(3), 205

Marinak, B., & Gambrell, L. (2009). Ways to teach about informational text. *Social Studies and the Young Learner*, *22*(1), 19-22.

McFall, R. (2005) Electronic textbooks that transform how textbooks are used. The Electronic Library, 23(1), 72-81.

McGowan, M. K., Stephens, P. R., & West, C. (2009). Student perceptions of electronic textbooks. *Issues in Information Systems*, *10*(2), 459-465.

Mc Laughlin, G. H. (1969). SMOG grading-a new readability formula. *Journal of Reading*, *12*(8), 639-646.

McNabb, M. L., Hassel, B., & Steiner, L. (2002). Literacy Learning on the Net: An Exploratory Study. *Reading Online*, *5*(10).

Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *Journal of Adolescent & Adult Literacy*, *52*(2), 96-107.

Mokhtari, K., & Reichard, C. (2002). Assessing students' metacognitive awareness of reading strategies. Journal of Educational Psychology, 94 (2), 249-259.

Morgan, R. F., Meeks, J.W., Schollaert, A., & Paul, J. (1986) Critical reading/thinking skills for college student. Dubuque, IA: Kendall-Hunt.

Murray, B. A. (2012). *Making sight words: Teaching word recognition from phoneme awareness to fluency: How to help children read words effortlessly without memorization*. Ronkonkoma, NY: Linus Publications.

Pearson, P. D., Roehler, L. R., Dole, J. A., & Duffy, G. G. (1992). Developing expertise in reading comprehension. In S. J. Samuels & A. E. Farstrup (Eds.), What research has to say about reading instruction (pp. 145-199). Newark, DE: International Reading Association.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: Authors.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards for English language arts and literacy in history/social studies, science, and technical subjects*. Washington, DC: Authors.

National Reading Panel (US), National Institute of Child Health, & Human Development (US). (2000). *Report of the national reading panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. National Institute of Child Health and Human Development, National Institutes of Health.

New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66*(1), 60-92.

Oliver, I. (2009). An investigation of concept mapping to improve the reading comprehension of science texts. *Journal of Science Education and Technology, 18*, 402-414.

Olson, M. W., & Gee, T. C. (1991). Content reading instruction in the primary grades: Perceptions and strategies. The Reading Teacher, 45, 298-307.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology*, *8*(3), 293-316.

Paris, S. G., & Winograd, P. (1990). How metacognition can promote academic learning and instruction. *Dimensions of Thinking and Cognitive Instruction*, *1*, 15-51.

Park, H., & Helsel, C. (2008). Differences between reading electronic and book-based text: Suggestions and implications for literacy teachers and literacy teacher educators. *Journal of Reading Education*, *33*(3), 28.

Pearson, P. D., & Dole, J. A. (1987). Explicit comprehension instruction: A review of research and a new conceptualization of instruction. *The Elementary School Journal*, 151-165.

Pintrich, P. R. (2002). The role of metacognitive knowledge in learning, teaching, and assessing. *Theory into Practice*, *41*(4), 219-225.

Porter-O'Donnell, C. (2004). Beyond the Yellow Highlighter: Teaching Annotation Skills to Improve Reading Comprehension. *English Journal*, *93*(5).

Pressley, M., & Hilden, K. (2006). Cognitive strategies. *Handbook of child psychology*.

Raphael, T. E. (1984). Teaching learners about sources of information for answering comprehension questions. *Journal of Reading*, *27*(4), 303-311.

Rinehart, S.D., Stahl, S. A., & Erickson, L. G. (1986). Some effects of summarization training on reading and studying. *Reading Research Quarterly, 21*, 422-438.

Roberts, K. D., Takahashi, K., Park, H. J., & Stodden, R. A. (2012). Supporting struggling readers in secondary school science classes. *Teaching Exceptional Children*, *44*(6), 40.

Rockinson-Szapkiw, A. J., Courduff, J., Carter, K., & Bennett, D. (2013). Electronic versus traditional print textbooks: A comparison study on the influence of university students' learning. *Computers & Education*, *63*, 259-266.

Rosenshine, B. (2012). Principles of instruction: Research-Based strategies that all teachers should know. *American Educator*, *36*(1), 12.

Rouse, M. (2005). ICT (information and communications technology-or technologies). *Dostupno na: http://searchcio-midmarket. techtarget. com/definition/ICT (27.02. 2013.)*.

Scammacca, N., Roberts, G., Vaughn, S., Edmonds, M., Wexler, J., Reutebuch, C. K., & Torgesen, J. K. (2007). Interventions for Adolescent Struggling Readers: A Meta-Analysis with Implications for Practice. *Center on Instruction*.

Shepperd, J. A., Grace, J. L., & Koch, E. J. (2008). Evaluating the electronic textbook: Is it time to dispense with the paper text?. *Teaching of Psychology*,*35*(1), 2-5.

Schmitt, M. C., & Newby, T. J. (1986). Metacognition: Relevance to instructional design. *Journal of Instructional Development*, *9*(4), 29-33.

Schraw, G., Crippen, K. J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, *36*(1-2), 111-139.

Schraw, G., & Moshman, D. (1995). Metacognitive theories. *Educational psychology review*, *7*(4), 351-371.

Schugar, H. R., Smith, C. A., & Schugar, J. T. (2013). Teaching with interactive picture e-books in grades K–6. *The Reading Teacher*, *66*(8), 615-624.

Singer, J., & Maher, M. A. (2007). Preservice teachers and technology integration: Rethinking traditional roles. *Journal of Science Teacher Education*, *18*(6), 955-984.

Spence, D. J., Yore, L. D., & Williams, R. L. (1999). The effects of explicit science reading instruction on selected grade 7 students' metacognition and comprehension of specific science text. *Journal of Elementary Science Education*, *11*(2), 15-30.

Sloan, R. H. (2012). Using an eTextbook and iPad: results of a pilot program. *Journal of Educational Technology Systems*, *41*(1), 87-104.

Snow, C. (2002). Reading for understanding: Toward an R&D program in reading comprehension. Arlington, VA: Rand Corporation

Sternberg, R. J. (1984). What should intelligence tests test? Implications for a triarchic theory of intelligence for intelligence testing. *Educational Researcher, 13* (1), 5-15.

Sternberg, R. J. (1986a). Inside intelligence. *American Scientist, 74*, 137-143.

Sternberg, R. J. (1986b). Intelligence applied. New York: Harcourt Brace Jovanovich, Publishers.

Stone, C. A. (1998). The metaphor of scaffolding its utility for the field of learning disabilities. *Journal of Learning Disabilities*, *31*(4), 344-364.

Street, B. (2003). What's "new" in New Literacy Studies? Critical approaches to literacy in theory and practice. *Current Issues in Comparative Education*, *5*(2), 77-91.

Sun, J., Flores, J., & Tanguma, J. (2012). E-Textbooks and students' learning experiences. *Decision Sciences Journal of Innovative Education*, *10*(1), 63-77.

"superordinate, adj. and n." *OED Online*. Oxford University Press, September 2015. Web. 20 November 2015.

Sykora, C. (2014, June 29). Plan a successful 1:1 technology initiative. March 01, 2016, from (https://www.iste.org/explore/articleDetail?articleid=36).

Toppo, G. (2012, January 31). Obama wants schools to speed digital transition. July 4, 2015. (http://usatoday30.usatoday.com/news/education/story/2012-01-31/schools-e-textbooks/52907492/1).

U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), various years, 1990–2015 Reading Assessments. Retrieved from http://www.nationsreportcard.gov/reading_math_2015/#reading?grade=4

Ukrainetz, T. A. (2015). Improving text comprehension: Scaffolding adolescents into strategic reading. *Seminars In Speech And Language*, *36*(1), 17-30. doi:10.1055/s-0034-1396443

Vygotsky, L. S. (1978). Mind in society: The development of higher mental processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: Harvard University Press.

Walling, D. R. (2014). Designing learning for the tablet classroom: Innovations in instruction. New York: Springer.

Wilhelm, J. D. (2001). *Improving comprehension with think-aloud strategies*. Scholastic Inc.

Wilson, J. (1999). Defining metacognition: A step towards recognising metacognition as a worthwhile part of the curriculum. In *AARE conference, Melbourne*.

Wittrock, M. C., & Alesandrini, K. (1990). Generation of summaries and analogies and analytic and holistic abilities. *American Educational Research Journal*, *27*(3), 489-502.

Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. Journal of Child Psychology and Psychiatry and Allied Disciplines, 17, 89-100.

Woody, W. D., Daniel, D. B., & Baker, C. A. (2010). E-books or textbooks: Students prefer textbooks. *Computers & Education*, *55*(3), 945-948.

Wright, S., Fugett, A., & Caputa, F. (2013). Using E-readers and Internet Resources to Support Comprehension. *Educational Technology & Society*,*16*(1), 367-379.

Young, T. A., & Ward, B. A. What Is Informational Text?.

Zimmerman, B. J. (1990). Self-regulating academic learning and achievement: The emergence of a social cognitive perspective. *Educational Psychology Review*, *2*(2), 173-201.

Zimmerman, B.J. (2000). Attainment of self-regulation: A social cognitive perspective. In M. Boekaerts, P.R. Pintrich, & M. Zeidner (Eds.), Handbook of self-regulation (pp. 13-39). San Diego, CA: Academic Press.

Appendix A

Teacher interview questions

1. What are your academic experiences with technology integration?
2. How do you integrate technology into your daily classroom operations?
3. What professional development have you attended to assist you in integrating the e-textbook in your curriculum?
4. How are e-textbook expected to be used in your classroom?
5. How do you integrate literacy into your curriculum?

Appendix B

Code Book

Device Usage: This theme was used when participants intentionally used their e-textbook for the academic purpose of reading. Sub-code was developed to further explain how and if the participants were using the e-textbook.

Present not using (PNU): this code meant that although a participant device was visibly present to the researcher, the participant chose not to engage in the process of reading from the device. Therefore, not interacting with the e-textbook features.

Dead (D): this code meant that the participants had possession of the iPad but did not interact with the device because it was either dead or charging.

Book over iPad (B.O.I.): this code meant that the participants chose to read from a traditional textbook instead of reading from the iPad even though the device was present.

Disable: this code was used when participants had their device in class, but did not have access to the e-textbook because they were locked out of the device.

Other: this code was used when participants had their device, but were using it leisurely. (i.e. social media, playing music, watching Netflix)

Feature Usage: This theme was used to determine if participants in either group used features of the e-textbook while engaging in the reading process.

Highlight (H): this code was used when participants used the highlighting feature in the e-textbook to highlight text.

Note (N): this code was used when the participants used the note-taking (e.g. sticky note) feature in the e-textbook to take additional notes from the teacher lecture.

Define (D): this code was used when participants used the define feature to gather more information on unknown words.

Translation (T): this code was used when an ELL participant used the translation feature to translate text into Spanish.

Instruction: this theme was used to determine if the teacher participant reinforced direct instruction of each intervention.

Model (M): this code was used when the teacher participant made instruction visible by showing how to use features of the e-textbook and connect them to strategies.

Appendix C

Student E-textbook Observation Protocol

1. How many participants have their iPads?

Number of students with iPad	
Number of students using the iPad for learning	
Number of students using the iPad for other purposes	
Number of students without an iPad	

Comment (s):

2. If independent reading is assigned during class time, how many participants are reading from the e-textbook?

3. What strategies are students employing while reading from an e-textbook?

Strategy	Student Usage
Question Generation: QAR	
Summarization: About Point	
Content Literacy Guide	
Other	

t

Comment (s):

4. How are students using side-by-side to assist reading comprehension? (describe what you see)

App. Features	**Student Usage**
Web search	
Defining words	
Looking up information	
Pronunciation	
Book is open	
Taking notes	
Using camera	
Saving and storing files	
Other	

Comments(s):

5. Are students using additional external resources to assist with comprehension?

Appendix D

E-textbook Knowledge Survey

Ethnicity origin (or Race): Please specify your ethnicity.
White
Hispanic or Latino
Black or African American
Native American or American Indian
Asian / Pacific Islander
Other

What is your age?
13-14
15-16
17-18
19-21

What is your grade level? (according to current earned credit hours)
9
10
11
12

What is your gender?
Male
Female

I know how to operate an electronic textbook (e-textbook).
Yes
No
Unsure

Reading from an e-textbook is easy.
Yes
No
Unsure

I was taught by a teacher, parent, and/or librarian, to read from an electronic textbook.
Yes
No
Unsure

Prior to this class, I have experience with using an electronic textbook.
Yes
No

Unsure

I have experience with using e-textbooks for academic purposes.
Yes
No
Unsure

I am aware that e-textbooks have built-in features (audio, bookmarks, highlighting, annotation, etc.) to help with reading.
Yes
No
Unsure

I know how to use e-textbook capabilities (audio, bookmarks, highlighting, annotation, etc.).
Yes
No
Unsure

I use e-textbook capabilities (audio, bookmarks, highlighting, annotation, etc.) to help me understand or remember what I just read.
Yes
No
Unsure

While reading from an e-textbook, I apply comprehension strategies that I was taught to understand the text.
Yes
No
Unsure

I use comprehension strategies to help understand text while I am reading.
Yes
No
Unsure

When I do not understand what I have just read, I used comprehension strategies and try again.
Yes
No
Unsure

I use comprehension strategies while I am reading.
Yes
No
Unsure

I need a tutorial on how to use e-textbooks.

Yes
No
Unsure

My teacher takes the time to explain how to use features of the e-textbook.
Yes
No
Unsure

My teacher models how to use features of the e-textbook while reading.
Yes
No
Unsure

My teacher explains comprehension strategies to make reading from an e-textbook easier.
Yes
No
Unsure

My teacher provides instruction on comprehension strategies when reading from an e-textbook.
Yes
No
Unsure

Using the features (audio, bookmarks, highlighting, annotation, etc.) of an e-textbook while reading prevents me from understanding the text.
Yes
No
Unsure

Using comprehension strategies make reading from an e-textbook easier.
Yes
No
Unsure

Using comprehension strategies while reading from an e-textbook are distracting.
Yes
No
Unsure

Appendix E

Pre-Test

Chapter 7

1. Electric charge that has accumulated on an object is referred to a____?
    a. Circuit electricity
    b. Current circuit
    c. Current electricity
    d. Static electricity

2. The rate at which an electrical device converts energy from one form to another is called____?
    a. Electrical energy
    b. Electrical power
    c. Electrical resistance
    d. Voltage regulation

3. A static discharge differs from an electric current in that a static discharge____?
    a. Involves the movement of ions as well as electrons
    b. Is a flow of electrons
    c. Last for only a fraction of a second
    d. Results because a force is exerted on the electrons

Chapter 11

4. Sound travels in a _____wave.
    a. Transverse
    b. Compressional
    c. Surface
    d. Inverted

5. The speed of sound in_____is greater than the speed of sound in water.
    a. Air
    b. Steel
    c. Cork
    d. Water vapor

6. If the intensity of a sound decreases, the_____decreases.
    a. Wavelength
    b. Speed
    c. Spinal pitch
    d. Loudness

Chapter 15

7. Three examples of physical change are_____.

a. Boiling of water, bursting of a balloon, and crumpling a piece of paper
b. Burning of gasoline, rotting of an egg, and exploding fireworks
c. Freezing of water, evaporation of gasoline, and rusting a nail
d. Sawing of wood, crushing a can, and toasting a marshmallow

8. Fog is an example of a____.
   a. Colloid
   b. Compound
   c. Solution
   d. Substance

9. When a log burns in a fire, ___.
   a. A physical change has occurred
   b. Mass is gained
   c. Mass is lost
   d. New substances are formed

Chapter 10

10. What do waves carry?
    a. matter
    b. energy
    c. waves
    d. water

11. What are the two types of mechanical waves?
    a. Transverse and compressional waves
    b. Seismic and water waves
    c. Energy and seismic waves
    d. None of the above

12. A compressional wave does not have which of the following:
    a. Crest
    b. Rarefaction
    c. troughs
    d. both a and c
    e. none of the above

13. How is wavelength measured in a compressional wave?
    a. Crest to crest
    b. Rarefaction to rarefaction
    c. Crest to trough
    d. Rarefaction to crest

14. When does refraction occur?

a. When light passes through instead of air
b. When waves change direction after they change speed
c. When waves bend around an object
d. None of the above

15. When two or more waves overlap, this is known as
    a. Interference
    b. Resonance
    c. Energy
    d. Compression

Chapter 17

16. Dot diagrams are used to represent___?
    a. Atomic numbers
    b. Atomic mass
    c. Isotopes
    d. Outer level electrons

17. A chemical symbol represents the___of an element.
    a. Name
    b. Reaction
    c. Group
    d. Structure

18. Atoms of the same element with different numbers of neutrons are called____?
    a. Isotopes
    b. Metals
    c. Metalloids
    d. Radioactive elements

19. Elements that are gases, are brittle, and are poor conductors at room temperature are____?
    a. Metals
    b. Nonmetals
    c. Metalloids
    d. Isotopes

20. A certain atom has 26 protons, 26 electrons, and 30 neutrons. Its mass number is____?
    a. 26
    b. 30
    c. 52
    d. 56

Appendix F

Post Test

Chapter 7

1. Resistance is measured in a unit called the____?
    a. Ampere
    b. Coulomb
    c. Ohm
    d. Volt
2. The statement that current is equal to voltage difference divided by the resistance is known as_____?
    a. Einstein's equation
    b. Farday's law
    c. Newton's law
    d. Ohm's Law

Chapter 11

3. The way your brain interprets the intensity of a sound is the____?
    a. Loudness
    b. Pitch
    c. Frequency
    d. Amplitude
4. The unit used to measure frequency is the___?
    a. Newton
    b. Joule
    c. Decibel
    d. Hertz
5. A system of using the reflection of underwater sound waves is___?
    a. Acoustics
    b. Rader
    c. Sonar
    d. Resonance
6. ____is another name for homogeneous mixture.
    a. Liquid
    b. Solution
    c. Substance
    d. Suspension
7. When two or more substances are combined so each substance can be separated by physical means, the result is a(n)___.
    a. Chemical change
    b. Element
    c. Compound
    d. Mixture

8. The scattering of light by colloids is called___.
    a. Air pollution
    b. Conservation
    c. Suspension
    d. The Tyndall effect

Chapter 17

9. Particles of matter that make protons and neutrons are____.
    a. Electrons
    b. Isotopes
    c. Quarks
    d. Atoms
10. Horizontal rows of the periodic table are called___.
    a. Clusters
    b. Families
    c. Groups
    d. Periods
11. A particle that moves around the nucleus is a(n)____?
    a. Electron
    b. Proton
    c. Neutron
    d. Quark

Chapter 10

12. A repeating disturbance or movement that transfers energy through matter or space.
    a. Transverse wave
    b. Wave
    c. Mechanical wave
    d. Compressional wave
13. Check all that apply: Which of these are types of waves?
    e. Medium waves
    f. Transverse waves
    g. Compressional waves
    h. Water waves
    i. Sound Waves
14. What type of wave is described as moving back and forth along the same direction that the wave travels?
    a. Compressional wave
    b. Transverse wave
    c. Medium wave
    d. Energy wave
15. A pebble is dropped in the lake and forms a ripple of waves, what is the medium?
    a. Water
    b. Pebble

c. Waves
d. All of the above

16. What makes up a transverse wave?
    a. Rarefaction
    b. Crests
    c. Rarefaction and crest
    d. troughs
    e. Crest and troughs
17. How is wavelength measured in a compressional wave?
    a. Crest to crest
    b. Rarefaction to rarefaction
    c. Crest to trough
    d. Rarefaction to crest
18. What is the SI unit of frequency?
    a. ohm
    b. hertz
    c. meters
    d. centimeters
19. The law of reflections state that? (summarization type question)
    a. The Angle of incidence is equal to the angle of reflection
    b. The Angle of reflection is perpendicular to the angle of incidence
    c. The Angle of incidence is parallel to the normal line
    d. None of the above
20. What type of wave is formed when wavelengths and amplitude are equal?
    a. Standing waves
    b. Transverse waves
    c. Compression waves
    d. Seismic waves

Appendix G

i-Marsi pre/post survey

i-Pad Metacognitive Awareness of Reading Strategies Inventory (_i_-MARSI)
Cardullo, Wilson, & Zygouris-Coe (2015)

DIRECTIONS: Listed below are statements about what people do when they read <u>academic or school- related materials</u> such as textbooks, library books, etc. using an iPad. Five numbers follow each statement (1, 2, 3, 4, 5) and each number means the following:

- **1** means "I **never or almost never** do this."
- **2** means "I do this **only occasionally.**"
- **3** means "I **sometimes** do this." (About **50%** of the time.)
- **4** means "I **usually** do this."
- **5** means "I **always or almost always** do this."

After reading each statement, **circle the number** (1, 2, 3, 4, or 5) that applies to you using the scale provided. Please note that there are **no right or wrong answers** to the statements in this inventory.

Factor	**STRATEGIES**	**SCALE**				
DSMS	1. I have a purpose in mind when I read text on an iPad.	1	2	3	4	5
SMMS	2. I take notes electronically when I read on a iPad to help me understand what I read.	1	2	3	4	5
DSMS	3. I look carefully at the accuracy of Internet sources when I read	1	2	3	4	5
DSMS	4. I preview the digital text by scrolling up or down, or left or right to see what the text is about before reading it.	1	2	3	4	5
DSMS	5. I can combine information I read from multiple websites.	1	2	3	4	5
SMMS	6. When text becomes difficult, I use iPad features to listen to the text being read (e.g., audio narration).	1	2	3	4	5
SMMS	7. I use annotation features or apps on the iPad to summarize what I read to reflect on important information in the text.	1	2	3	4	5
DSMS	8. I think about whether the content of the text fits my reading purpose.	1	2	3	4	5
DSMS	9. When I read text on an iPad I read slowly but carefully to be sure I understand what I'm reading.	1	2	3	4	5
SMMS	10. I discuss what I read with others using discussion tools such as chat to check my understanding.	1	2	3	4	5
SMMS	11. I discuss what I read with others using discussion tools such as discussion boards, wikis and blogs to check my understanding.	1	2	3	4	5
DSMS	12. I skim the text first by examining length and organization.	1	2	3	4	5
DSMS	13. I check the reliability of the information when I use the Internet.					

DSMS	14. I try to get back on track when I get distracted by pop ups or advertisements.	1	2	3	4	5
SMMS	15. I underline or circle information electronically in the text to help me remember it.	1	2	3	4	5
SMMS	16. I click on words or hyperlinks to define words electronically in the text to help me remember it.	1	2	3	4	5
DSMS	17. I adjust my reading speed according to what I'm reading online or in an e-text.	1	2	3	4	5
SMMS	18. I adjust the font size according to what I'm reading.	1	2	3	4	5
DSMS	19. I decide what to read closely and what to ignore when reading text online.	1	2	3	4	5
SMMS	20. I use the find feature to see where else the author has used a term or phrase in the text to help me understand what I read.	1	2	3	4	5
SMMS	21. I use hyperlinks to search for reference materials such as dictionaries and webpages to help me understand what I read.	1	2	3	4	5
DSMS	22. When text becomes difficult, I pay closer attention to key words, hyperlinks, or text features in what I'm reading.	1	2	3	4	5
SMMS	23. When text becomes difficult, I often bookmark the page so I can come back to it after reading a little more.	1	2	3	4	5
SMMS	24. When reading texts on the iPad do you text-code or annotate the text as you read? (Example: highlighting in different colors, writing on sticky notes, underlining…)	1	2	3	4	5
SMMS	25. I use tables, figures, and pictures in text to increase my understanding.	1	2	3	4	5
SMMS	26. I stop from time to time and think about what I'm reading and take electronic notes.	1	2	3	4	5
DSMS	27. I use context clues or click on the word to look up the definition to help me better understand what I'm reading.	1	2	3	4	5
DSMS	28. I paraphrase (restate ideas in my own words) to better understand what I read.	1	2	3	4	5
DSMS	29. I try to picture or visualize information to help me remember what I read.	1	2	3	4	5
SMMS	30. When I read on an iPad I often search for pictures or visuals to help me make connections while I am reading.	1	2	3	4	5
DSMS	31. When I read on a digital device I focus on understanding the main points that are bolded, italicized, or colored to indicate a hyperlink.	1	2	3	4	5
SMMS	32. I critically analyze and evaluate the information presented in the text and verify the information through an Internet search.	1	2	3	4	5
SMMS	33. I often use the find feature to go back and forth in the text to find relationships among ideas.	1	2	3	4	5
SMMS	34. When I read on an iPad I check my understanding when I come across conflicting information by completing a web search, or finding other electronic information related to what I am reading.	1	2	3	4	5

DSMS	35. I try to make predictions about what the material is about when I read.	1	2	3	4	5
DSMS	36. When reading on an iPad if the text becomes difficult, I re-read to increase my understanding.	1	2	3	4	5
SMMS	37. I navigate from e-book to Internet and back in a clear logical path.	1	2	3	4	5
SMMS	38. I scan a digital page or pages looking for key words and phrases to focus on what is important.	1	2	3	4	5
SMMS	39. I often flip back and forth in the e-text to look for additional information as I read for meaning.	1	2	3	4	5

*This survey is a modified version of MARSI (Mokhtari & Reichard, 2002; Mokhtari, Sheorey, & Reichard, 2008), for Digital Devices.
Approval given from Mokhtari & Reichard on 1/28/16 waiting on APA permission.

***i-Pad* Metacognitive Awareness of Reading Strategies Inventory *i*-MARSI**
SCORING RUBRIC

Student Name: ____________________ Age: ________ Date: ________________

Grade in School: □ 6th □ 7th □ 8th □ 9th □ 10th □ 11th □ 12th □ College □ Other

1. Write your response to each statement (i.e., 1, 2, 3, 4, or 5) in each of the blanks.
2. Add up the scores under each column. Place the result on the line under each column.
3. Divide the score by the number of statements in each column to get the average for each subscale.
4. Calculate the average for the inventory by adding up the subscale scores and dividing by 39.
5. Compare your results to those shown below.
6. Discuss your results with your teacher or tutor.

Device Supported Metacognitive Strategies **(DSMS)**	Self-Monitoring Metacognitive Strategies **(SMMS)**	Overall Reading Strategies
1.________		
3.________	2. _______	
4.________	6.________	
5.________	7. _______	Device Supported Metacognitive Strategies **(DSMS)**
8.________	10. _______	
9.________	11.________	
12._______	15. _______	_________________
13._______	16. _______	
14.________	18. _______	Self-Monitoring Metacognitive Strategies **(SMMS)**
17.________	20. _______	
19.________	21. _______	
22. _______	23. _______	_________________
27.________	24. _______	
28. _______	25. _______	
29. _______	26. _______	
31. _______	30. _______	
35. _______	32.________	
36. _______	33. _______	
	34. _______	
	37. _______	
	38. _______	
	39. _______	
________ DSMS Score	________ SMMS Score	_______ Overall Score
________ DSMS Mean	________ SMMS Mean	_______ Overall Mean

KEY TO AVERAGES: 3.5 or higher = High 2.5 – 3.4 = Medium 2.4 or lower = Low

INTERPRETING YOUR SCORES: The overall average indicates how often you use reading strategies when reading academic materials. The average for each subscale of the inventory shows which group of strategies (i.e., Device Supported Metacognitive Strategies or Self-Monitoring Metacognitive Strategies) you use most when reading. With this information, you can tell if you are very high or very low in either of the two strategy groups. It is important to note, however, that the best possible use of these strategies depends on your reading ability in English, the type of material read, and your purpose for reading it. A low score on any of the subscales or parts of the inventory indicates that there may be some strategies in these parts that you might want to learn about and consider using when reading (adapted from Oxford 1990: 297- 300).

Revised Appendix C

Device Supported Metacognitive Strategies
Examples include setting a purpose, looking at the accuracy of information, previewing text for content by scrolling, paying attention to text features (hyperlinks, bold, color or italized text), making decissions in relation to what to read carefully or closely to enhance reading comprehension.
(Items 1,3,4,5,8,9,12,13,14,17,19,22,27,28,29,31,35,36)

Self Monitoring Metacognitive Reading Startegies
Examples include tking notes electronically, using features of the iPad to listen to the text annotations, using discussion tools (chat, wikis, or blogs) to discuss text with others, using reference tools (electronic dictionary, adjust font size, using search feature to look for key terms and navigate through the electronic text using features in the e-book or i-pad to support reading comprehehnsion.
(items 2,6,7,10,11,15,16,18,20,21,23,24,25,26,30,32,33,34,37,38,39)

Appendix H

Research Focus Group Questions

1. What does comprehension mean to you?
2. Is comprehending different when reading from an e-textbook? If so, in what way?
3. Do you use strategies to understand physical science material while reading from an e-textbook? What are some strategies you use?
4. Before the study began, how familiar were you with the features installed in the e-textbook?
5. What features of the e-textbook did you use prior to the study? Where they helpful in understanding the material?
6. If you were familiar with e-textbook features, who would you credit for teaching you how to use these features?
7. How do your understanding of physical science material was impacted because you were aware of e-textbook features?
8. How do you think your understanding of physical science material was impacted because you were aware of reading strategies?
9. What features do you believe were most helpful while reading from an e-textbook?
10. **Additional comments?**

Appendix I

Overall student attitude on e-textbooks

Statement	Yes	No	Unsure
Prior to this class, I have experience with using an electronic textbook.	19 (95%)	1 (5%)	0 (0%)
I use comprehension strategies while I am reading.	18 (95%)	0 (0%)	1 (5%)
When I do not understand what I have just read, I used comprehension strategies and try again.	17 (89%)	0 (0%)	2 (11%)
I use comprehension strategies to help understand text while I am reading.	16 (84%)	0 (0%)	3 (16%)
I am aware that e-textbooks have built-in features (audio, bookmarks, highlighting, annotation, etc.) to help with reading.	17 (81%)	2 (10%)	2 (10%)
Using comprehension strategies make reading from an e-textbook easier.	14 (78%)	0 (0%)	4 (22%)
I know how to operate an electronic textbook (e-textbook).	17 (77%)	0 (0%)	5 (23%)
Reading from an	17	1	4

e-textbook is easy.	(77%)	(5%)	(18%)
I know how to use e-textbook capabilities (audio, bookmarks, highlighting, annotation, etc.).	15 (75%)	1 (5%)	4 (20%)
While reading from an e-textbook, I apply comprehension strategies that I was taught to understand the text.	15 (75%)	0 (0%)	5 (25%)
My teacher provides instruction on comprehension strategies when reading from an e-textbook.	12 (67%)	3 (17%)	3 (17%)
I have experience with using e-textbooks for academic purposes.	13 (65%)	5 (25%)	2 (10%)
My teacher takes the time to explain how to use features of the e-textbook.	12 (63%)	4 (21%)	3 (16%)
I was taught by a teacher, parent, and/or librarian, to read from an electronic textbook.	13 (62%)	7 (33%)	1 (5%)
My teacher explains comprehension strategies to make reading from an e-textbook easier.	10 (59%)	4 (24%)	3 (18%)
I use e-textbook	11	5	4

capabilities (audio, bookmarks, highlighting, annotation, etc.) to help me understand or remember what I just read.	(55%)	(25%)	(20%)
My teacher models how to use features of the e-textbook while reading	8 (42%)	9 (47%)	2 (11%)
Using comprehension strategies while reading from an e-textbook are distracting.	3 (18%)	13 76%	1 (6%)
Using the features (audio, bookmarks, highlighting, annotation, etc.) of an e-textbook while reading prevents me from understanding the text.	3 (17%)	12 (67%)	3 (17%)
I need a tutorial on how to use e-textbooks.	2 (11%)	12 (67%)	4 (22%)

Appendix J

AUBURN
UNIVERSITY

COLLEGE OF EDUCATION

CURRICULUM AND TEACHING

The Auburn University Institutional Review Board has approved this document for use from 8/12/15 to 8/11/16
Protocol # 15-321 MR 1508

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

INFORMED CONSENT
for a Research Study entitled
"Electronic Textbooks and Student Comprehension"

You are invited to participate in a research study to help us examine the connection between comprehension strategy instruction and electronic textbooks. The study is being conducted by Le'Nessa L. Clark, Doctoral student, under the direction of Dr. Bruce Murray, Associate Professor in the Auburn University College of Education. You were selected as a possible participant because you are currently a high school science teacher at Charles Henderson High that teaches three identical courses, and students are enrolled in your classes.

What will be involved if you participate? If you decide to participate in this research study, you will be asked to allow the researcher to audio record observations of your classroom for two to three times a week for a total of nine weeks in which the researcher will take notes and photos of student interactions with the electronic textbook. During the nine weeks, the researcher will instruct you how to integrate comprehension strategies into your curriculum and to connect these strategies to the features in an electronic textbook. This training will approximately take two additional hours of your time. Upon the completion of the strategy training, you will be expected to teach your science classes how to connect comprehension strategies to the features of the electronic textbook. You will also be expected to provide updates on student grades participating in the study. Finally, the study will conclude with your participation in an audio recorded interview which should last no longer than 30 minutes. The entire study will take place over a span of eleven weeks, with four additional weeks to allow for any make-up research.

Are there any risks or discomforts? The risks associated with participating in this study are minimal beyond what you may experience in regularly scheduled teaching. In order to keep your information confidential, you will be assigned a pseudonym for all observations and interview.

Are there any benefits to yourself or others? You will receive individualized coaching on how to integrate the usage of electronic textbooks into your curriculum. You will understand how to use the electronic textbook for purposes beyond substitution. In addition, you will receive hands-on training on how to model and instruct your students to use empirically based comprehension strategies, and how to connect those strategies to the features in electronic textbooks. This study will also serve as an evaluative resource for the College of Education as it relates to improving the Reading Education Teacher Education program, and enhancing the services they provide to the student population at Auburn University.

Participant's initials_________

5040 HALEY CENTER
AUBURN, AL 36849-5212

TELEPHONE:
334-844-4434

FAX:
334-844-6789

www.auburn.edu

Page 1 of 2

AUBURN
UNIVERSITY

The Auburn University Institutional Review Board has approved this document for use from 8/12/15 to 8/11/16 Protocol # 15-321 MR 1508

5040 HALEY CENTER
AUBURN, AL 36849-5212

TELEPHONE:
334-844-4434

FAX:
334-844-6789

www.auburn.edu

COLLEGE OF EDUCATION

CURRICULUM AND TEACHING

Will you receive compensation for participating? Although no compensation is provided for participating in this study, your time is appreciated.

Are there any costs? You will not incur any cost as a participant in this study.

If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, the College of Education or Charles Henderson High School.

Any data obtained in connection with this study will remain confidential. We will protect your privacy and the data you provide by using pseudonyms and codes; in addition, store the information in a secure area. The interviews will be audio taped and encrypted in a file on a hard drive. Audio tapes will be transcribed verbatim and pseudonyms used for any names or information that could be identifying. Hard drives will be maintained in a secure location and all files and information which could identify you will be destroyed prior to the closure of the study, expected May 2018.

Information collected through your participation will be used to fulfill an educational requirement of a dissertation and for the furtherance of the field of Reading through published research articles in professional journals and presentations at professional meetings and conferences.

If you have questions about this study, please ask them now or contact LeNessa L. Clark at 217-597-5457 or llc0012@auburn.edu or Dr. Bruce Murray, at murraba@auburn.edu.

If you have questions about your rights as a research participant, you may contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334)-844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. IF YOU DECIDE TO PARTICIPATE, THE DATA YOU PROVIDE WILL SERVE AS YOUR AGREEMENT TO DO SO. A COPY OF THIS LETTER WILL BE GIVEN TO YOU.

______________________________ ______________________________
Participant's signature Date Print Name

______________________________ ______________________________
Investigator's signature Date Print Name

Page 2 of 2

Appendix K

AUBURN UNIVERSITY

COLLEGE OF EDUCATION

CURRICULUM AND TEACHING

The Auburn University Institutional Review Board has approved this document for use from 8/12/15 to 8/11/16 Protocol # 15-321 MR 1508

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

PARENTAL PERMISSION/CHILD ASSENT
for a Research Study entitled
"Electronic Textbooks and Student Comprehension"

Your son or daughter is invited to participate in a research study to help us to examine the connection between comprehension strategy instruction and electronic textbooks. The study is being conducted by Le'Nessa L. Clark, Doctoral student, under the direction of Dr. Bruce Murray, Associate Professor in the Auburn University College of Education. Your child was selected as a possible participant because he/she is a student currently enrolled in a science class at Charles Henderson High School. Since he/she is age 18 or younger we must have your permission to include him/her in the study.

What will be involved if your son/daughter participates? If you decide to allow him/her to participate in this research study, he/she will be asked to allow the researcher to audio record observations of him/her for two to three times a week for a total of nine weeks in which the researcher will take notes and photos of his/her interactions with the electronic textbook during his/her science class only. During the nine weeks, he/she will be instructed by the teacher on integrating comprehension strategies while reading from an electronic textbook, and connecting these strategies to the features in an electronic textbook. Instruction will be integrated into daily lessons and not interrupt classroom learning. Your child will also be asked to complete a confidential survey about his/her knowledge of electronic textbooks. To measure comprehension growth, the researcher is requesting permission to access your child's reading, chapter and unit exam grades during the study. This information will be kept confidential and will be destroyed once the data has been analyzed. Finally, your child may be selected to participate in interviews, which will be audio recorded and should last no longer than 30 minutes during his/her lunch period, nor interrupt instructional time. The entire study will take place over a span of eleven weeks, with four additional weeks to allow for any make-up research.

Are there any risks or discomforts? The risks associated with participating in this study are minimal beyond what he/she may experience in regularly scheduled student learning. Participation in this study is not mandatory and will not affect your child's grade. In order to keep his/her information confidential, she/he will be assigned a pseudonym for the survey, interview and observations.

Are there any benefits to your son/daughter or others? The results from this study may benefit the student. The implications from this study may assist in professional development that addresses successful technology integration into the classroom. Furthermore, it can teach students how to use technology for academic uses and apply comprehension strategies to e-textbooks to propel comprehension of informational textbooks.

Parent/Guardian Initials_____ Participant Initials_____

Page 1 of 2

5040 HALEY CENTER
AUBURN, AL 36849-5212
TELEPHONE:
334-844-4434
FAX:
334-844-6789
www.auburn.edu

AUBURN
UNIVERSITY

COLLEGE OF EDUCATION

CURRICULUM AND TEACHING

The Auburn University Institutional Review Board has approved this document for use from 8/12/15 to 8/11/16 Protocol # 15-321 MR 1508

Will there be compensation for participating? If interviews take place during your child's lunch period, pizza will be provided; otherwise no compensation is provided for participating in this study.

Are there any costs? You will not incur any cost as a participant in this study.

If you (or your son/daughter) change your mind about his/her participation, he/she can be withdrawn from the study at any time. His/her participation is completely voluntary. If you choose to withdraw your son/daughter, his/her data can be withdrawn as long as it is identifiable. Your decision about whether or not to allow your son/daughter to participate or to stop participating will not jeopardize your or his/her future relations with Charles Henderson High School, its faculty and administration, Auburn University, the College of Education or the Reading Education program.

Your son's/daughter's privacy will be protected. Any information obtained in connection with this study will remain confidential. The data collected will be protected by using pseudonyms and codes; in addition, the information will be stored in a secure area. The interview will be audio taped and encrypted in a file on a hard drive. Audio tapes will be transcribed verbatim and pseudonyms used for any names or information that could be identifiable. Hard drives will be maintained in a secure location and all files and information which could identify your child will be destroyed prior to the closure of the study, expected May 2018.

If you have questions about your child's rights as a research participant, you may contact the Auburn University Office of Research Compliance or the Institutional Review Board by phone (334)-844-5966 or e-mail at IRBadmin@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR SON OR DAUGHTER TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW HIM OR HER TO PARTICIPATE. YOUR SON'S/DAUGHTER'S SIGNATURE INDICATES HIS/HER WILLINGNESS TO PARTICIPATE.

Participant's signature Date	Investigator obtaining consent Date
Printed Name	Printed Name
Parent/Guardian Signature Date	
Printed Name	

Page 2 of 2

5040 HALEY CENTER
AUBURN, AL 36849-5212

TELEPHONE:
334-844-4434

FAX:
334-844-6789

www.auburn.edu

Appendix L

Student RECRUITMENT SCRIPT (verbal, in person)

Hello, my name is LeNessa Clark, and I am a graduate student in the College of Education at Auburn University. I would like to invite you to participate in my research study to examine the connection between comprehension strategy instruction and electronic textbooks. You may participate if you are currently a student enrolled in a science course, and the teacher is using electronic textbooks for the Fall 2015 semester.

As a participant, you will be asked to allow the researcher to audio record observations of your classroom interactions with the e-textbook for a total of nine weeks. You will receive teacher instruction on how to integrate empirically based comprehension strategies in connection with features of the electronic textbook into your daily lessons. You will complete a survey about your knowledge and application of electronic textbooks. You will allow the researcher to take non-identifiable photos of your interaction with the electronic textbook. You will be asked allow the teacher to provide the researcher grades from your reading, chapter and unit exams. Once your grades have been analyzed, you may be selected to participate in an individual interview that should last no longer than thirty minutes each.

The risks associated with participating in this study are minimal beyond what you may experience in regularly scheduled teaching. In order to keep your information confidential, you will be assigned a pseudonym for your survey, interview and observations. Participation in this study is not mandatory and will not affect your grade.

The results from this study may be beneficial for students and teachers. The implications from this study may assist in professional development that addresses successful technology integration into the classroom. Furthermore, this study can teach teachers and students how to use technology for academic uses and apply comprehension strategies to e-textbooks to propel comprehension of informational texts. The study will serve as an evaluative resource for the College of Education as it relates to improving and informing practice in the Reading Education Teacher Education Program, and enhancing the services they provide to the student population here at Auburn University.

If you are selected to participate in the interviews during phase two of the study, you will be treated to pizza during your lunch period

You will not incur any cost as a participant in this study.

If you would like to participate in this research study, please provide me with your contact information so I can provide you with more information.

Are there any questions? If you have questions later, please contact me at Llc0012@auburn.edu

Appendix M

Teacher RECRUITMENT SCRIPT (verbal, in person)

Hello, my name is LeNessa Clark, and I am a graduate student in the College of Education at Auburn University. I would like to invite you to participate in my research study to examine the connection between comprehension strategy instruction and electronic textbooks. You may participate if you are currently a science teacher with three identical science courses, using electronic textbooks, and have students enrolled in your courses for the Fall 2015 semester.

As a participant, you will be asked to allow the researcher to audio record observations of your classroom for a total of nine weeks. You will also work with the researcher to develop lesson plans in which you will implement and integrate empirically based comprehension strategies in connection with features of the electronic textbook. You will allow the researcher to take non-identifiable photos of student interaction with the electronic textbook. You will be asked to supply the researcher with student grades from teacher made assessments (e.g. reading, chapter and unit exams). Once the grades have been analyzed, you and a selected group of students will be asked to participate in individual interviews that should last no longer than thirty minutes.

The risks associated with participating in this study are minimal beyond what you may experience in regularly scheduled teaching. In order to keep your information confidential, you will be assigned a pseudonym for your survey, interview and observations.

The results from this study may be beneficial for students and teachers. The implication from this study may assist in professional development that addresses successful technology integration into the classroom. Furthermore, this study can teach teachers and students how to use technology for academic uses and apply comprehension strategies to e-textbooks to propel comprehension of informational text. In addition, you will receive one-to-one assistance in developing lessons to improve comprehension in your class. The study will serve as an evaluative resource for the College of Education as it relates to improving and informing practices in the Reading Education Teacher Education Program, and enhancing the services they provide to the study population here at Auburn University.

Although no compensation is provided for participating in this study your time is appreciated.

You will not incur any cost as a participant in this study.

If you would like to participate in this research study, please provide me with your contact information so I can provide you with more information.

Are there any questions? If you have questions later please contact me at llc0012@auburn.edu