

EXPLORING THE IMPACT OF ELECTRONIC TEXTBOOK TOOLS ON STUDENT
ACHIEVEMENT IN WORLD HISTORY

by

Cathy E. Bonner

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The College of Education
in Partial Fulfillment of the Requirements for the Degree of
Doctor of Philosophy

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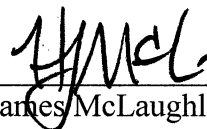
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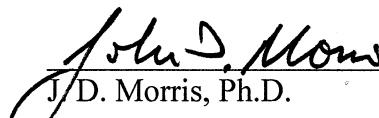
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This dissertation was prepared under the direction of the candidate's dissertation advisor, Dr. Harry James McLaughlin, Department of Curriculum, Culture, and Educational Inquiry, and has been approved by the members of her supervisory committee. It was submitted to the faculty of the College of Education and was accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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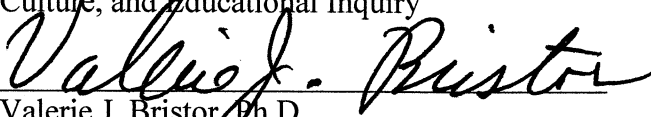
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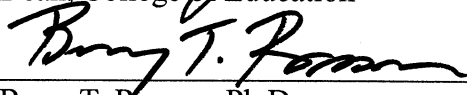
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ABSTRACT

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This mixed-methodology study examined the effect of using Electronic textbook highlight and animation tools on the knowledge and comprehension achieved by 10th-grade students. Eighty-two students enrolled in a regular World History course were purposefully selected and assigned to 1 of 4 groups: (a) Highlight, (b) Animation, (c) Highlight-and-Animation, or (d) Comparison. A One-Way ANCOVA with a Bonferroni Adjusted Alpha was used in analyzing the results of the knowledge and comprehension World History pretest and posttest that were administered. A Factorial ANCOVA with a Bonferroni Adjusted Alpha was used in analyzing the influence of the Scholastic Reading Inventory (SRI) moderator. Using the eEdition World History textbook tools of highlight and animation did not significantly impact the World History knowledge and comprehension scores achieved by participants and the participant's SRI level did not significantly moderate the relative effectiveness of the conditions.

Interview data from 3 Student Focus groups and 1 Teacher Focus group were analyzed with an open exploratory coding strategy. The resulting classification code of “ease of use” was characterized by: (a) time required to learn to use the tools, and (b) time to complete the tasks. A second code, “choice” was characterized by: (a) choice of instruction tools, and (b) choice in monitoring and assessing student activity. The focus groups indicated that they would use the tools in the future due to benefits such as the ability to modify the information to match their learning and instructional preferences. They also stressed that more instruction on the use of eEdition tools was needed.

DEDICATION

This manuscript is dedicated to Russell Francis. I hope the sacrifices we have made will enrich your life far into the future. I love you.

EXPLORING THE IMPACT OF ELECTRONIC TEXTBOOK TOOLS ON STUDENT
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CHAPTER 1

INTRODUCTION

Academic attainment varies greatly among students. For instance, the average vocabulary of a 4-year-old student with parents who are professionals is twice the vocabulary of a student whose parents are on welfare (Barton, 2006; Jerald, 2006). Students of professional parents are more likely to perform better in reading and vocabulary than students from welfare homes. The wide differences in educational development among students are reflected on assessments across the nation. National assessments such as the 2008 National Assessment of Educational Progress (NAEP) U.S. History test indicated that Hispanics and African American students had the lowest average scores of all the ethnic groups taking the test (Lee & Weiss, 2007).

Ethnicity is inextricably linked to achievement, based on the current educational practices to report achievement patterns by ethnic groups (Raven, 1989). Low achievers are often identified as ethnic minorities such as African Americans and Hispanics because these groups are highly represented in the low-achieving populations, based on national and state testing data (Moore, Ford, & Milner, 2005). Moore et al. (2005) termed the lagging academic achievement of ethnic minorities in comparison to White students as the *achievement gap*. Low achievement is characterized by poor academic performance on high-stakes assessments, repetition of one or more grades, or low grade point average (Chapin, 2006; McCombs, 2000; Moore et al., 2005).

The failure of the K through 12 public education system to meet the academic needs of low achievers is revealed by the 2008 U.S. History portion of the National Assessment of Educational Progress (NAEP), in which the average score of a low-achieving 8th-grade student is akin to the average score of 4th-grade students (Barton, 2006; Walston, Rathbun, & Germino, 2008). In 1994, the average low achiever in fourth, eighth, and twelfth grade earned 31, 34, and 30 points respectively on the NAEP U.S. History test. Meanwhile, the average fourth, eighth, and twelfth grade student overall earned 44, 47, and 43 points respectively. In the fourth, eighth, and twelfth grades the academic gap remains at 13 points for all levels, so the approximately 30% achievement gap on U.S. History knowledge remains fairly consistent as students are promoted from one grade to the next. These scores seem to indicate greater possibilities of low-achieving students dropping out of school.

To further clarify the severity of the dropout problem, in Florida, almost 100,000 students did not achieve graduation status at the close of the 2006 to 2007 school year (Florida Department of Education [FLDOE], 2007a). The academic shortfalls of low achievers are evidenced when they enter school. Starting academically behind their peers, they are positioned even further behind when the overall instruction is unsuitable to their academic needs. A pattern of low academic achievement continues and eventually many drop out of school.

The evidence from research findings demonstrate that many factors influence a student's ability to achieve on par with peers. A NAEP 2001 survey of U.S. History 8th-grade teachers revealed that students of teachers who supported the textbook with primary historical documents on a weekly basis had higher scores than students of

teachers who used the supplementary resources less often (U.S. Department of Education [U.S.D.O.E], 2001). Likewise, 12th-graders who reported using extra materials to supplement the textbook had higher scores than those who did not add supplementary information to the textbook content (U.S.D.O.E, 2001). Adding resources to support the textbook content appears to be a successful strategy for increased achievement. Many low-achieving students rarely make academic gains to become on par with higher achievers, and when readers encounter difficulty in reading textbook content they often require further support while reading , which is not always available from the teacher.

Textbooks are the guiding structure and organization pattern for the content of teachers' lesson plans, the major support of most teaching and learning situations (Herlihy, 1991), and are the most widely used instructional resource (Alridge, 2006; Apple, 1986; Bain, 2006; Banks, 2000; Beimer, 1991; Gordy & Pritchard, 1995; Hedrick, Harmon, & Linerode, 2004; Lerner, Nagai, & Rothman, 1995; Moreau, 2003; Stahl, Hynd, Britton, McNish, & Bosquet, 1996). In many cases, textbooks have become the curriculum (Beimer, 1991), and many teachers rely on them as the final word in instruction (Giroux, 1983). Down (1988) explains: "Textbooks, for better or worse, dominate what students learn. They set the curriculum, and often the facts learned, in most subjects. For many students, textbooks are their first and sometimes only exposure to books and to reading" (p. 19).

Bruner (1960) asserted that: "Limiting instruction to a steady diet of classroom recitation supported only by traditional and middling textbooks can make lively subjects dull for the student" (p. 88). Boring, dull material textbooks could disconnect learners from the instructional process, result in disillusionment or disinterest, or serve to further

exacerbate academic failure (Wolf, 1992). Ravitch (2003) believed that “the textbooks lacked the capacity to inspire, sadden, or intrigue their readers” (p. 111). Static history textbooks stagnate in comparison with the technological support features that are contained in the electronic versions. Electronic textbooks contain tools to highlight or animate information and these capabilities could significantly impact student achievement due to their interactive capabilities that offer students different ways to extend their knowledge.

The abysmal academic achievement clearly indicates the need for research into how textbook content can be expanded to address academic achievement. Electronic textbooks abound with tools to highlight and animate information, but sparse research is available to determine the influence of using electronic textbook tools on the achievement of 10th-grade students. This research undertaking was intended to address the gap in research by investigating how the use of highlighting and animation electronic textbook tools impact student achievement.

Statement of the Problem

The No Child Left Behind (NCLB) Act was intended to close the achievement gap (Azzam, Perkins-Gough, & Thiers, 2006; Jerald, 2006; Manzo, 2005) but sustained academic gains for low achievers have been absent since the passing of the NCLB Act in 2001. Since 1992, the gap in the NAEP social studies and reading scores ranged between 30 to 38 points. Also, the reading scores for some student groups have not reflected consistent gains since 2005 (Hawkins, Stancavage, Mitchell, Goodman, & Lazer, 1998; Lee, Grigg, & Donahue, 2007).

Thousands of students achieve at low academic levels or drop out of school on an annual basis (Planty et al., 2008). Students who lag academically require more academic support because they could lack competency at the reading level for which textbooks are written. Textbooks are used by over 70% of teachers and students on a daily basis but traditional textbooks are unable to address the instructional needs of low-achievers. Electronic textbooks are available online and incorporate a variety of tools such as animation and highlight. These tools also include a variety of features such as sounds and pop-up information that could be sources of interest, motivation, and enjoyment for readers. The electronic textbook tools could serve as mnemonic devices or as guides to concepts, stories, and ideas for all students, including those who are at risk of educational failure or who may be learning a second language (Lambert & Carpenter, 2005). Currently, little research is available that has investigated the use of highlight and animation electronic textbook tools to determine their impact on student achievement.

Purpose of Study

Currently available data of educational progress at the K through 12 levels indicate significant gaps in reading ability and achievement for some students. The rapid increase and availability of various educational technologies to aid in learning could impact reading ability and achievement. Therefore, the intention of this research is to explore how students' use of highlighting and animation eEdition tools during reading may impact their achievement.

Rationale

Prior to my current position as a high school administrator, I taught Social Studies at the middle and high school levels in Florida. Due to the high degree of importance that

I placed on reading proficiency, reading skills and strategies have always been an essential component of my lessons. My students read at various proficiency levels and came from a wide range of socio-economic backgrounds but, during my teaching experience it was obvious that students' low reading ability significantly impacted their success in social studies and every content area class. Academic success in social studies is directly tied to reading the social studies textbooks as well as to the reading ability of the student (Gillet, Temple, & Crawford, 2004; Hoyt, 2002). Most of my students did not have the reading ability to comprehend the textbook because they were English Language Learners (ELL) or because the textbook was written at a readability level above their capability.

Reading ability is integral to a student success in reading informational texts in content areas such as social studies. The inextricable link between reading and social studies is demonstrated by the advocacy of school districts for the incorporation of reading strategies into content area courses (Palm Beach School District [PBSD], 2008). Many social studies textbooks challenge student by exposing learners to a wealth of information, concepts, and vocabulary that are often left uncovered in other content areas. Thus, a deeper and wider understanding of topics and ideas can be promoted.

Reading researchers such as Marzano, Pickering, and Pollock (2001) identified highlighting as an important strategy for summarizing and note-taking during reading. The size of most textbooks and the time limitation upon instruction require the use of tools that draw student attention to key ideas. Thus, they can quickly return, as needed, to verify, review, or integrate the highlighted information with further information they read (Blachowicz & Ogle, 2001; Dorn & Soffos, 2005; Hoyt, 2002). However, the research on

the use of highlighting and animation features and the impact on achievement are focused at the college level and generalizing those findings to 10th-grade students poses difficulties, due to major differences in the population such as prior academic achievement.

The growing evidence show that learners are becoming more computer literate and that electronic instructional materials are becoming more prevalent. Therefore, more effort should be expended to study the effect of electronic textbook tools on student achievement. Further investigation on the use of electronic textbook tools such as highlighting and animation during reading is important because students who flounder academically could benefit if the findings reveal that highlighting and animation promote students' interest, motivation, and academic achievement.

The field of education and the businesses involved in writing and publishing textbooks are entrusted with the responsibility of improving students' educational possibilities by exposing them to worthwhile academic content. Investigating electronic textbook tools that could impact learning could help students, parents, schools, administrators, and other stakeholders who are concerned with the success of all children, to advocate for changes. Educators could also use the findings to guide their instructional practices. The findings could also help to fine-tune current understanding about the use of electronic textbook tools and contribute to future research efforts. Consequently, the researcher decided to investigate how the use of the highlight and animation tools in an electronic (eEdition) world history textbook would impact the achievement of 10th-grade students.

Significance of the Study

On April 3, 2008, a search was conducted using EBSCOhost. The search results for all documents in the SocINDEX, Academic Search Premier, and the American History Life database of EBSCOhost for the past 20 years resulted in two titles related to the search term *history textbook* and enhanced. A follow-up search, on September 4, 2009, with a 10-year limitation resulted in no results for the search term. The search terms *history textbook and multimedia*, *history textbook and animation*, and *history textbook and interactive* revealed similar results. A search of WilsonWeb using the same search time for all articles, with no year limitation, returned seven results. If textbook tools were discussed, the information provided was negligible. As of May 23, 2011, no research was found that investigated the use of electronic textbook tools to determine their impact on student achievement. The searches indicate a clear gap in research on electronic textbook tools and their use in secondary instruction.

Theoretical Framework

Social Constructivist, Dual Coding, and Cognitive Load Theory form the conceptual foundation for the study. In the following sections the key ideas from the theories will be discussed.

Social constructivist theory. Vygotsky (1986) strongly advocated the use of instructional scaffolding due to the uniqueness of the individual learner. Vygotsky theorized that learning is highly dependent on the socio-cultural context. An individual's background and needs are intricate and multifaceted, and require instruction that is geared toward the unique differences that result (Byrnes, 2001; Vygotsky, 1986). In Vygotsky's opinion, the main cognitive functions utilized by learners are language,

perception, thinking, attention, and memory (Byrnes, 2001). Vygotsky further postulated that learners call upon one or more of these cognitive abilities when exposed to learning situations, and these cognitive functions are best realized when learning occurs in a social milieu. Therefore, the type of learning that takes place in social settings is inextricably connected to the social forces guiding it.

Vygotsky's (1986) theory of the Zone of Proximal Development (ZPD) and Byrnes' (2001) theory of the More Knowledgeable Other (MKO) are also utilized to undergird this study. Vygotsky defined the gap between one's actual and potential state of development as the ZPD. The lowest spectrum of the ZPD represents what the learner could accomplish unaided, while the highest range of the ZPD epitomized the extent of the learning possible with assistance. The ZPD spans a continuum and encompasses the learning possibilities that could be achieved (Vygotsky, 1986).

Byrnes (2001) thought it possible for a learner to be educationally accomplished far beyond their maturity rate with an appropriate MKO. To bridge the gap between the actual and potential development, he identified the MKO as the individual or entity that can impart the knowledge necessary for the learner to acquire the understanding that would be beyond what is possible if they learned alone. He elaborated that the MKO could be a parent, teacher, or peer. Byrnes emphasized that without these MKO aids, learning new concepts would be haphazard for the learner. Learning would occur, but it would be on the lower limit of the ZPD in comparison to the potentially greater understanding that could be derived with assistance from the MKO. According to Darling-Hammond and Bransford (2005), the MKO could also be computers,

manipulatives, or other objects that could be used as knowledge bases and from which the knowledge can be efficiently acquired.

When there are tasks that are too challenging for the learner to undertake without assistance, the MKO scaffolds should be in the form of examples with verbalization and students imitating the skill demonstrated. The MKO incrementally monitors and removes the scaffolding until finally the learner independently shows mastery of the task (Byrnes, 2001; Darling-Hammond & Bransford, 2005). The assistance or scaffolding that is provided should be temporary and the instructor should assess attainment of the skill by encouraging students to draw a connection to their prior knowledge. The instruction should be structured to ensure that prior knowledge is assessed, due to the wide individual variations in learning ability, and it should also provide specific guidelines and foundation for learning success (Darling-Hammond & Bransford, 2005).

Vygotsky also believed in challenging learners, but the challenging experience should be tempered by practicality (Byrnes, 2001). For example, in reading about terrorism in a world history class, students can synthesize that knowledge with their prior knowledge and then use that understanding to judge terrorism as it exists today. Hence, the learner might be able to judge how their country, community, and family are indirectly impacted by terrorism via higher taxes or greater evidence of expanding security measures. The practicality of the knowledge is demonstrated when the learner is able to apply the knowledge learned to relevant real-world situations. Vygotsky (1986) clearly emphasized that worthy instruction is designed to challenge learners by extending their actual developmental capability. To achieve this aim, the instructor pinpoints the

learner's state of readiness and designs the instruction to enable, elicit, and cultivate a higher level of academic development (Darling-Hammond & Bransford, 2005).

Bruner (1960) agreed with Vygotsky that the task should be applicable to other situations, but added that the child's interest should be incited so that they would be motivated to tackle the task. Therefore, he felt teachers should be trained in and have wide access to numerous instructional supports to aid in developing a wider and a deeper grasp of knowledge that "expand experience, clarify it, and give it personal significance" (p. 91). Bruner identified instructional technologies as potentially valuable supports to instructional endeavors because they could alleviate the instructional load required by teachers and provide immediate feedback for learners.

The addition of scaffolding strategies to instruction could serve more than an embellishment or decoration function because numerous educators and researchers have noted their value in helping lower-achieving students to make the cognitive leaps necessary for knowledge attainment (Clark & Paivio, 1991; Eisner, 1990; Felten, 2008; Fischman, 2001; La Pierre, 1990; Park, 2001; Piaget, 1953; Piro, 2002; Sibbet, 2008; Stokes, 2001; Stokrocki, 1990; Zambo, 2005). Therefore, this study will focus on assessing the impact upon achievement when students use highlighting and animation electronic textbook tools to scaffold their learning. The Dual Coding Theory is discussed in the next section.

Dual coding theory. Clark and Paivio (1991) broadened the scope of understanding regarding the cognitive capabilities with the theory of Dual Coding. Paivio (1971) speculated that visual and verbal stimuli are attended to by separate regions of the brain and that recall can be improved by integrating visual support with verbal

information. According to Paivio's Dual Coding Theory, the single encoding potential of words and sentences places them second in value to visuals in many learning situations (Angeli & Valanides, 2004; Clark & Paivio, 1991; Gyselinck, Meneghetti, De Beni, & Pazzaglia, 2008; Price, 2004). Hence, Paivio (1971) believed that visuals are equal to words and he advocated for presenting both in learning situations. Paivio emphasized that the learning derived from exposure to words and visuals is often stronger and more concrete than learning gained from exposure to a single stimuli.

Situations in which learners are instructed by use of verbal and visual strategies lead to greater recall because of the association that can be drawn between words and pictures. Clark and Paivio (1991) indicated that scans of the brain clearly revealed that exposure to pictures and concrete words stimulate certain areas of the brain. As a result, new patterns are being created and learned constantly. So, if students are exposed to only verbal information, it implies that there are fewer modes in which the knowledge is represented and fewer opportunities to learn the information and to see information in different ways (Eisner, 2003; Stokrocki, 1990). The brain is able to work in whole or in parts. The simultaneous functioning potential of the brain necessitates variety in instruction. If information can be fine-tuned to strengthen a single brain function, then appropriate information should be identified and incorporated to strengthen other cognitive areas as well (Clark & Paivio, 1991). Paivio's (1971) theories are often linked with Cognitive Load Theory (CLT), and the CLT will be discussed in the following section.

Cognitive load theory. Cognitive Load Theory was formulated by Sweller (1988) while conducting an experiment on student problem-solving strategies. Most of

the participants utilized “means-ends” analysis. He believed the approach diverted unnecessary cognitive resources that could be focused on developing background knowledge. Sweller played an integral part in developing the concepts of intrinsic cognitive load, extraneous cognitive load, and germane cognitive load (Chandler & Sweller, 1991; Pollock, Chandler, & Sweller, 2002; Sweller, Van Merriënboer, & Paas, 1998).

Each learning task has a level of difficulty that is unchangeable and that is defined as the intrinsic cognitive load (Sweller, 1988). However, Sweller et al. (1998) believe the inherent difficulty in the task could be alleviated, to various degrees of success, depending on the instructional design.

Unlike intrinsic cognitive load, the extraneous and Germane cognitive load can be reduced. Extraneous cognitive load is concerned with presentation modality. Germane cognitive load is the effort required to process the stimuli and integrate it with prior knowledge in order for the concept to become automatic for the learner. While attending to stimuli, blending it with schema, or utilizing the new knowledge, learning can be compromised due to inappropriate instructional design (Sweller et al., 1998).

According to cognitive load theory, instruction in multiple modalities such as audio, visual, and textual can increase the brain’s processing and cognition of information (McLoughlin & Krakowski, 2001; Pollock et al., 2002). In complex situations, the additional learning load imposed by multiple modalities could compromise learning (Feldon, 2007). The overload in complex learning situation occurs because the multiple modalities of presentation require a greater amount of cognitive attention to the various

stimuli, as well as to the intrinsic complexity involved in the task being learned. Due to the cognitive overload, information is missed or the learning is negatively compromised.

In complex learning situations, learners who lack prior knowledge are disadvantaged in comparison to advanced learners because the cognitive demands required for the task could be developing for the novice learner, due to a lack of background knowledge or schema (Mayer, Hegarty, Mayer, & Campbell, 2005; Sweller et al., 1998). Automaticity, or the presence of prior experience and schema, makes cognition more efficient and quicker for advanced learners than it is for learners without the necessary background experiences and conceptual understanding (Clark & Paivio, 1991; Feldon, 2007). The extraneous cognitive load and other uncontrolled interference are important considerations in instruction, but more so in especially complex or high intrinsic cognitive load learning situations (Pollock et al., 2002; Sweller et al., 1998; Van Gog & Paas, 2008). However, for learning to take place the cognitive load should be at the optimum level. Otherwise, automaticity or negligible awareness results in no learning (Feldon, 2007; Clark & Paivio, 1991; Van Gog & Paas, 2008).

The Cognitive Load Theory insinuates the advantages of multiple presentation modalities. The use of multiple presentation modalities is suggested in order to target the different learning needs that could be encountered in the learning context. However, the potentially harmful impact of cognitive overload could be mitigated if learner characteristics are predetermined before instruction and if the applicable characteristics are considered in the instructional design.

Summary

Providing appropriate instructional support to struggling learners could serve to reduce the low academic achievement rates that are now evident across the nation.

Almost a century ago, Vygotsky pointed out that learners have different instructional needs due to the various cultural and social contexts they encounter (Vygotsky, 1986). He felt it was critically important that more knowledgeable support bases are identified and used to assist students to reach their highest potential. Bruner (1960) also agreed that learners have varying interests and these interests should be considered in selecting instructional support tools so that the highest degree of learning interest is generated. He advocated for automated devices, such as computer software programs, because they could reduce the instructional load placed upon teachers and because they could garner student interest in learning. Currently, classroom overcrowding and the rise of technology in education have resulted in greater focus on the potential of technology as a support to learning. The number of electronic textbook tools has increased in the past decade but no research is available that has addressed their effectiveness at the secondary level. Therefore, the analysis proposed could alert stakeholders to eEdition instructional tools that could be used during reading to address the academic achievement gap.

Research Questions

The research questions are:

1. How does the use of the electronic edition (eEdition) World History textbook highlighting and animation tools relate to the knowledge and comprehension achieved by students on a World History test of knowledge and comprehension?

2. Are the effects of the eEdition World History textbook tools of highlighting and animation moderated by student Scholastic Reading Inventory (SRI) level?
3. What are students' perspectives on using the highlighting and animation eEdition World History textbook tools while reading World History content?
4. What are teachers' perspectives on using the eEdition World History textbook highlight and animation tools in instruction?

Definitions of Terms

Animation. Simulated motion picture depicting movement of drawn (or simulated) objects (Mayer & Moreno, 2002).

eEdition textbook. Online textbook in which certain content can be augmented (Beck, Black, Krieger, Naylor, & Shabaka, 2005).

eEdition. Electronic edition (Beck et al., 2005).

Highlight. Use of a font color that differs from the text color to distinguish particular text information (De Ridder, 2002)

Multimedia. The combination of multiple media such as voice, video, and sound effects in a single presentation that allow user interaction with the information via the computer (Kingsley & Boone, 2008).

Textbook. The visual/verbal units of meaning that are the objects of analysis in this study.

Verbal. Written and auditory information (Paivio, 1971).

Visual. Photograph, painting, map, chart, diagram, illustration or the like that includes representation of individuals, abstractions, or ideas.

Limitations

1. The textbook contains more tools than were investigated in this study. For example, some of the tools allow access to audio or glossary enhancement. Therefore, students could inadvertently use the tools that are not associated with their condition.

2. Students have access to the traditional and eEdition textbook while off-campus. Therefore, students might have read the content before undergoing their assigned condition.

3. The animated visuals from the world history eEdition textbook content include 3 visuals that are not included in the traditional version of the textbook.

4. A single textbook was chosen because it was the only textbook adopted to teach World History to teach tenth grade and which also had the animation and highlighting capability that are the focus of this research.

5. The study participants had access to electronic textbooks tools, but had not used the tools prior to the study.

Delimitations

1. The duration of the study was limited due to regularly scheduled academic pursuits. Due to the time constraints, the study was limited to 3 months.

2. A further delimitation is that only one chapter was selected from the *World History: Patterns of Interaction* textbook to be used in the study. A study of further topics would require more time.

3. The eEdition contained additional eEdition World History textbook tools such as glossary and note-taking, but only the highlighting and animation tools were used in the study.

4. The assessment of achievement was limited to the first two levels of Bloom's Taxonomy of Educational Objectives due to the time limitation imposed on the study. Assessing knowledge acquisition at the higher levels of Bloom's Taxonomy would required more time for students to read and process the information in order to answer the questions.

5. The effect of teachers facilitating student use of the World History textbook on student achievement during the study was not investigated.

6. All of the teachers of 10th-grade social studies were asked to participate. They were given a Teacher Consent Form and only two of the four teachers of 10th-grade social studies returned the Teacher Consent Form.

Organization of the Study

After a thorough delineation of the problem in Chapter 1, Chapter 2 is a review of the literature on achievement results on national tests of history and reading, the impact of visuals on achievement, the impact of highlighting on achievement, and the impact of animation tools on achievement. Chapter 3 outlines the methodology implemented. An analysis of the data is in Chapter 4. The findings, recommendations, and conclusion are discussed in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

The research focused on assessing the impact of highlighting and animation electronic textbook tools on student achievement. To provide a foundation for the investigation and shed further insight on K-to-12 academic achievements, the pertinent research findings on student academic achievement and how academic achievement was impacted by the use of highlighting, animation, and visuals in instruction are discussed. To achieve this aim, the review of literature is divided into 6 sections. The first section discusses student achievement on National Assessments of history, while the second will summarize key issues related to the state of social studies in schools. The third, fourth, and fifth sections are overviews of the relevant research findings on how highlighting, animation, and visuals may impact achievement. The final section addresses various models of knowledge types and how knowledge acquisition can be assessed. Chapter 2 concludes with a summation of the literature reviewed.

Student Achievement on Assessments of History

In the following sections an overview of various assessments of history will be discussed to determine current student achievement patterns. The first sections will review achievement results from the Early Childhood Longitudinal Study-Kindergarten Class of 1998-1999 (ECLS-K) and the NAEP. The results of surveys conducted by NAEP will be discussed in the final sections.

The Early Childhood Longitudinal Study-Kindergarten (ECLS-K). The Early Childhood Longitudinal Study-Kindergarten Class of 1998-1999 (ECLS-K) (Chapin, 2006) provided data regarding student achievement on tests of historical knowledge. The pattern of failure for low-achieving students begins at an early age, as the ECLS-K documents. The ECLS-K, orchestrated by the U.S. Department of Education, assessed randomly selected kindergartners in 1998 and again in first, third, and fifth grades on their general knowledge of social studies and science (Chapin, 2006).

The ECLS-K results indicated significant achievement gaps because the scores for African Americans were almost one (1.00) standard deviation (SD) behind the score for White students (Fryer & Levitt, 2002). A standard deviation (SD) of 0.1 is insignificant, 0.3-0.5 SD is negligible, and 0.5 is considered significant (Chapin, 2006). Other assessments such as the NAEP assessment of history knowledge also revealed similar achievement patterns.

National Assessment of Educational Progress (NAEP) achievement data. In 1986 the NAEP initiated assessment of the history knowledge of high school students (Ravitch & Finn, 1987). Approximately 141 history questions assessed the basic history knowledge of about 8,000 students. Of the total number of students, 12.9% were African American, 5.9% Hispanic, 76.5% White, and the remainder were of other ethnicities. The scores for White and Asian students were significantly higher than the scores for African American and other ethnic groups. For example, the history proficiency scores for Whites and Asians were 290.8 and 292.3, respectively. To the contrary, the mean score for African Americans was 263.1.

By 1994, the NAEP Assessment had widened in scope to include fourth and eighth grade. In fourth, eighth, and twelfth grade, almost 20,000 students took the geography assessment and over 20,000 took the U.S. history assessment (Hawkins et al., 1998). In fourth grade, the average item score for African Americans was 31 points in U.S. history and geography; in eighth grade, the average item score was 34 points for both areas, and in high school, 36 points for geography and 30 points for U.S. history. To the contrary, in fourth grade, the average item score for White students was 51 points in geography and 44 points in history. In eighth grade, White students scored 54 points in geography and 47 points in U.S. history. In twelfth grade, they scored 54 points in geography and 43 points in U.S. history. Although the scoring mechanisms had changed from 1986 to 1994, a widening gap was evident because the scores for groups such as African American were 34% to 42% lower than the scores for Whites on the 1994 history assessment. In the previous administration, the gap was approximately 13% (Hawkins et al., 1998).

The most recent report by the NAEP of U.S. history knowledge continued to document the overall trend of academic failure for certain groups (Planty et al., 2008; Walston et al., 2008). As in previous years, of all groups tested, African Americans earned some of the lowest scores on the history assessment. Based on the report, in 2006, 54% of African Americans and 16% of White fourth graders were below proficiency. Only 46% of African Americans fourth graders were at the proficiency level, while the percentage of White fourth graders at the proficiency level was almost twice that of African Americans. By eighth grade, the percentage of above-proficiency and at-proficiency level scores had dropped by 6% for African Americans, and by twelfth grade, the gap had widened significantly. For example, in contrast to the 44% below-proficiency

rate for Whites, the below-proficiency rate for twelfth grade African Americans was 80%. The at-basic rate was 56% for Whites and 20% for African Americans. Only 2% of African Americans earned an at- or above-proficiency rating in contrast to 16% of White students. The fourth and eighth grade U.S. history results also documented a similar picture of student academic achievement. The 1994 NAEP U.S. history assessment also reported student and teacher responses to the use of history textbooks, primary sources, and extra written materials in instruction. Pertinent findings from the NAEP survey will be reviewed in the following paragraphs.

Assessment of Educational Progress (NAEP) Survey Data

According to the surveyed 4th-grade and 8th-grade teachers of history, 43% indicated they used textbooks daily, while 44% used the textbooks once or twice a week (Hawkins et al. 1998). Of the students surveyed, 46% reported that books were used daily, 25% stated that textbooks were used 25% of the time, 13% reported never, and the remaining 16% answered the textbook was used once or twice a month, or a few times a year. Therefore, it is evident that the majority of the students and teachers used textbooks because the majority of respondents, 60% of teachers and 38% of students, never used primary sources or documents outside the textbook during instruction. A large number of survey participants, 43% of teachers and 46% of students, stated that textbooks were used on a daily basis.

The 60% daily rate of use of the U.S. history textbook is also consistent with previous findings by Stahl et al. (1996), Apple (2004), and Hedrick et al. (2004) that more than 50% of social studies teachers were heavily reliant on the textbook and Hedrick et al. (2004), that more than 80% of teachers, rate their history textbook as

between adequate and very good. The instructional importance of textbooks is evidenced by the high usage rate reported by students and teachers who took the 2006 NAEP survey. It is possible that academic achievement in social studies can be influenced by factors such as the resources and materials that are used in instruction as well as the instructional practices in schools and classrooms. The following section discusses some of the issues related to social studies instruction.

Approaches to Social Studies Instruction

Jerald (2006) and Pederson (2007) believe the eroding social studies curriculum, the unintended impact of various high-stakes assessments and the federal No Child Left Behind (NCLB) Act contribute to the achievement gap between Whites and other groups such as African Americans and Hispanics. In the past 5 years, an ongoing trend of “teaching what is tested” has led to a systemic narrowing of social studies curriculum nationwide (Amrein & Berliner, 2003; Heafner et al., 2006; Jerald, 2006; Leming, Ellington, & Schug, 2006; Pederson, 2007). Other authors believe that the demands of the test often lead to a suspended or eliminated curriculum (Burroughs, Groce, & Webeck, 2005). The trend has led to a primary focus on reading, math, and science achievement and the subsequent practice of reducing the instructional time devoted to social studies (Evans, 2006; Heafner et al., 2006).

The reduced instructional time in social studies is most evident in elementary, middle, and low-performing schools (Burroughs et al., 2005; Manzo, 2005). Almost half of these schools had reduced the time normally provided for the teaching of social studies (Dillon, 2006; Jones & Thomas, 2006), which could help to explain the dismal U.S. history scores for African Americans and other ethnic groups. A teacher survey

conducted by the federal government revealed that in the past 10 years, the amount of instructional time spent on math and reading in elementary schools increased by 96 minutes because time was deducted from instruction in social studies and science (Burroughs et al., 2005). In Maryland, half of the principals polled indicated a decrease in social studies instructional time and a growing reliance on teaching what is tested (Amrein & Berliner, 2003; Mathis, 2003). The students most impacted by this practice are African Americans and Hispanics and they often perform poorly on national assessments of content such as history.

Some schools reduce or pull students out of untested content area classes based on the belief that if more time is devoted to the tested area, the achievement gap will be reduced. Unfortunately, testing data continued to indicate negligible achievement gains (Pederson, 2007; Rock et al., 2006). Some psychologists and educators advise against a limited curriculum, especially in the early academic years. They stress the importance of a more comprehensive curriculum due to its advantages in helping students to become well-rounded citizens and successful in their academic endeavors (Fleury, 2005; Rock et al.; Stern, 2005). They believe that a wide curricular focus exposes students to the many varied learning opportunities, whereas a limited curriculum could lead to boredom and failure (Marzano, Kendall, & Cicchinelli, 1999; McGuire, 2007; Pederson, 2007).

Some educators believe that the dismal results on state and national high-stakes tests are due to the inherent cultural bias in the test items or test items that are far-flung from what was actually taught (Dillon, 2006; Evans, 2006; Pellegrino, Baxter, & Glaser, 1999). Thus, content that is not tested at the state level, such as history, is reduced or eliminated from the curriculum. In addition, Pellegrino et al. explained that many of the

test items on national assessments are selected without regard for what was taught. The situation is also exacerbated by the lack of a unified national standard curriculum with accompanying curricular mapping of what should be taught and when and why it should be taught, as well as what should be tested. Consequently, the piecemeal compilation of test items is significantly divorced from what is actually taught

The current achievement pattern necessitates investigation of potential instructional supports that could address the achievement gap. In the following pages research on the use of highlighting in instruction will be discussed. Unfortunately, the most recent research on highlighting and animation tools is mostly focused on students and content at the university level. To date, few research findings are available to add to current understanding of how the use of the electronic textbook highlighting tools during reading influences the achievement of secondary students.

The Impact of Highlighting on Achievement

The impact of highlighting on student achievement has little research available that is relevant to K-to-12 populations. To date, most of the available research on the use of highlighting is relegated to university students. To assess the current research data on the impact of highlighting on achievement, the impact of highlighted vocabulary will be discussed in the first section. In the remaining section, the research on the impact of appropriate highlighting on student achievement will be discussed. A summation of the research will close this section.

The impact of highlighted vocabulary on achievement. A university-level research study by De Ridder (2000) investigated whether highlighted written information impacted student reading process and their comprehension of a second language. In the

research, De Ridder also investigated if students were more likely to click vocabulary if it was highlighted and whether the highlighted vocabulary impacted student learning behavior. The researcher postulated that highlighted vocabulary would evoke quicker response, as evidenced by student clicking on the highlighted vocabulary, than would be the response time evoked by vocabulary without highlights. In addition, De Ridder predicted the participants would focus more on the highlighted vocabulary than onto the remaining reading content and would also spend more time clicking on highlighted words in order to access the linked definitions. In the first session, 17 university students were exposed to a reading passage that incorporated highlighting of vocabulary with links to dictionary definitions or to a condition without highlighted vocabulary, but with dictionary definitions that could be accessed by clicking on the unfamiliar or unknown vocabulary.

Afterward, a 27-item comprehension and vocabulary multiple-choice test was administered. The participants were also questioned to find out if they knew the vocabulary previous to or after the treatment and where they acquired previously known vocabulary. De Ridder (2000) reported that students exposed to the highlighting treatment earned a mean vocabulary score of 41%, while the mean score of students in the second treatment group was 34%. However, a week later the participants' recall of vocabulary was assessed and the mean score of the highlight group had fallen to 34.85%, but the mean score for the group without highlights showed a smaller decline as indicated by a mean score, posttreatment, of almost 31%. The comprehension results for the highlight vocabulary group and the unmarked vocabulary group were 82% and 72%

respectively. De Ridder also explained that the highlight treatment group devoted more time to clicking on highlighted vocabulary than did the group without highlights.

Of further interest to this research undertaking is De Ridder,s (2000) follow-up interview of the students. During the interview the students revealed that they used the highlighted vocabulary as a guide to discern the pattern of the content they read, and this provided an overall summary of the main ideas of the topic they read. The students answered that they felt impelled to click on highlighted words either out of curiosity, to verify their meanings, or to determine their meaning. Clicking the highlighted words resulted in an 80% correct response rate on the vocabulary test. De Ridder concluded that the highlighted vocabulary incidentally communicated important content that was integral to the overall understanding of the textual content.

In a study of 60 university students, De Ridder (2002) extended her earlier investigation to determine how the use of highlighting, or lack thereof, influenced student incidental vocabulary learning and if the type of task impacted the participant use of highlighted information. The results revealed that under both conditions the participants learned an almost equal amount of incidental vocabulary and, as in the previous study, the highlight treatment groups clicked the highlighted vocabulary more when the task was general than when it was specific. The appropriateness of highlighted content such as vocabulary could influence achievement and the available literature on appropriate highlighting is examined on the following pages.

The appropriateness of highlighting and student achievement. The appropriateness of the highlighted information in relation to the assessment task was investigated to determine possible influence on student achievement. Moravcsik and

Healy (1998) sought to determine how the appropriate use of highlighting impacted student comprehension of various reading passages. Sixty graduate and undergraduate students were divided among treatment conditions in which all the words in the passages were highlighted, no words were highlighted, or only important words were highlighted. The passages were taken from a 7th and 8th-grade standardized reading test. A comprehension test was given afterward and it revealed that the mean score of the participants in the Highlight Important Words condition was lower than the mean score of the other groups. A second experiment was conducted to determine if informing students that the highlighted words were important, to comprehend the passage would impact the results. The results again revealed that the important words highlighted group had a lower mean score than the other treatment groups.

However, Moravcsik and Healy (1998) explained that the difference between the mean score of the Highlight Important Words group and that of the other two groups was not statistically significant for both experiments. In the first experiment the mean score of the Highlight Important Words group was .778, while the score of the Highlight All Words and the Highlight No Words group were .787 and .780 respectively.

A negligible difference in the mean scores was also evidenced by the later experiment that gauged how informing the participants of the importance of the highlighted words would impact the results. Moravasik and Healy (1998) also utilized the participants' verbal Scholastic Aptitude Test (SAT) score to determine if the student's verbal ability impacted their results under the varying treatment conditions. They concluded that the participants with greater reading ability, as determined by their verbal SAT score, were more disadvantaged if the important words were highlighted than were

the participants who had lower verbal SAT scores under the same treatment condition. Previous research by Wade and Trathen (1989) revealed that subjects with higher verbal ability and higher prior knowledge were disadvantaged when learning from information that was highlighted than were the participants with lower verbal ability and lower prior knowledge.

Automaticity, or the presence of prior experience and schema, makes cognition more efficient and quicker for advanced learners than it is for learners without the necessary experience and conceptual understanding (Feldon, 2007). Thus, learners with high prior knowledge possibly overlooked the redundancies and attended to the relevant information, while the students with lower prior knowledge attended to the text that was enhanced with highlighting. The impact of highlight type and the different results they can yield, depending on the verbal ability of students, means that if highlighting is inappropriately structured, designed, and used in instruction, academic achievement can be compromised for some students.

In a study on the use of highlighting, Silvers and Kreiner (1997) focused on the appropriateness of the text that was highlighted to determine the impact on the reading comprehension of 114 university students. The participants were randomly assigned to a No Highlighting, Appropriate Highlighting, or Inappropriate Highlighting condition. They expected that students would be distracted by the inappropriate highlighting. The results indicated that the Inappropriate Highlight group received the lowest scores and that the mean score of the Appropriate Highlight and the Appropriate Highlight group were not significantly different statistically.

In a follow-up study, Silvers and Kreiner (1997) investigated whether or not warning participants of the inappropriateness of highlighting would impact their previous findings. Silvers and Kreiner tested a group of 111 university students and as before, utilized the No Highlighting, Appropriate Highlighting, or Inappropriate Highlighting conditions but deviated by warning students in the Appropriate Highlight and Inappropriate Highlight groups that the highlighting could be helpful or harmful and they could choose to overlook the highlights. As in the first experiment, the mean score of the Inappropriate Highlight group was lower than either of the other groups, but no significant difference was noted between the scores of the No Highlight group and the Appropriate Highlight group.

Chi, Gumbrecht, and Hong (2007) decided to track eye movements to identify if the presence of highlighted textual information impacted eye movement. They predicted that the research subjects would focus on the highlights in order to learn what was read. Six subjects were given 12 factual questions to complete under a No Highlight, Keyword Highlighting, or a ScentHighlights treatment condition. Chi et al. described ScentHighlights as a software program that automatically highlight sentences and keywords based on a keyword search. An EyeLink Intelligent Eye Tracking System was worn by each participant to discern their eye movements.

The test results indicated that the ScentHighlight treatment condition resulted in 100% accuracy while the mean score of the No Highlighting and Keyword Highlighting group was .92 and .79 respectively. The researchers also reported that when the text was highlighted, significantly more attention was directed to the highlighted information, based on the eye tracking data. For instance, the gaze of the ScentHighlights treatment

group was directed at highlighted information over 70% of the time when they initially began the treatment and over 50% of the ScentHighlights measured eye fixations were directed to highlighted information. The eye fixation of the Highlight Keyword group was 43%. The small sample in this study mitigates possibly generalization of the findings. However, the eye tracking data clearly indicated that more attention was devoted to highlighted information versus other text. Therefore, the results added to current understanding of the role that highlighting could play in directing learner attention to important information.

Highlighting information attracts attention, as shown by Chi et al. (2007) and Moravcsik and Healy (1998). In a later study, the appropriateness of the highlighting was investigated by So and Chan (2009). They investigated how the accuracy of validity of the highlighted information influenced comprehension. Validity was determined by the accuracy of the highlighted information in relation to the comprehension test items. They set 0%, 33%, 67%, and 100% as the levels of highlight validity to which the participants would be treated. Highlights that did not contribute to answering the comprehension test questions were at the 0% validity level and detailed the first treatment condition. In the second treatment condition one of three highlighted keywords was correct and at the 100% validity level all the highlighted words contributed to accurate responses on the comprehension test. In the control condition, no words were highlighted. All 38 undergraduate participants underwent the five treatment conditions. The results revealed that the mean scores of the highlight groups were higher than the mean score of the No Highlight group. In addition, when the validity highlight level was at 100%, the

comprehension mean score for the group exposed to that treatment was 85%. The scores of the remaining highlight treatment groups ranged from 71% to 73%.

Summary

Overall, available research on highlighting and how it impacts achievement focused on predefined highlighting conditions that were beyond the control of the research subjects. Wade and Trathen (1989) found that when participants were actively engaged in selecting the text to highlight, their processing and retention of the material surpassed that of the participants who did not utilize the highlighting capability. Research on guiding students in the selection of text to highlight while they read was unavailable. Silvers and Kreiner (1997) stressed the need for more research to determine how student active involvement in selecting the text to be highlighted would impact their achievement. The following section of the literature reviewed will address how the use of animation impacted student achievement.

The Impact of Animation on Achievement

Similar to the research on highlighting, the available research on animation is predominantly reflective of the achievement patterns of populations at the university level. The lack of available research on the impact of animation on the achievement of students at the K-to-12 levels imposes difficulties in assessing the effectiveness of highlighting or animation. The following sections discuss the impact of animation speed, user-controlled animation, cued animation, and animation format on student achievement. The closing sections will provide an overview of findings on instructional design of animations, followed by a summary.

The impact of animation speed on student achievement. Animations can allow the user to control the speed at which the animation is played. Meyer, Rasch, and Schnotz (2010) investigated how the speed of an animation would impact processing and cognition of a given stimuli. Meyer et al. assessed the prior knowledge of 55 university students about the processes of a 4-stroke internal combustion engine. In the first of two studies, user controlled animations were utilized and participants could select one of six speeds at which to play the animation. The researchers hypothesized that animations played at a slower speed would accentuate micro-events and those played at higher speeds would stress macro-events. Meyer et al. (2010) defined micro-events as shorter than macro-events and elaborated that while a macro event would show a part of a process, such as an intake valve opening, an example of a macro-event would be a rotation of the cam drive in a 4-stroke combustion engine. They explained further that the intake valve opening is one of many micro-events that are included in the process for the rotation of the cam drive. The results showed that over 50% of the participants preferred when the animation played at the lowest speed. However, the higher the speed of the animation, the participants comprehended more macro-events than they did the micro-events.

In a second study, Meyer et al. (2010) controlled the speeds at which the animation played to determine if participants would attend to more micro than macro-events. The study was comprised of 19 university students who also learned about the 4-stroke combustion engine, but the animation was automated to play for 2 minutes at a slow speed and then for a high speed for the same duration. The second treatment group was exposed to a reversal of the speed sequence. Meyer et al. concluded that the reversal

of the speeds did not impact the attention paid to macro versus micro events. Thus, regardless of speed sequence the learner focused more on micro-events than on macro-events initially, but attended to more macro-events in the latter portion of the animation. The ability of the user to control animation features such as speed is examined in the upcoming portions of the literature review.

The impact of user-controlled animation on student achievement. One of the few available studies on the use of animation at the K through 12 level was conducted by Kombartzky, Ploetzner, Schlag, and Metz (2010). In their study on animation, Kombartzky et al. investigated user-controlled audio animation that was enhanced with a learning strategy or without a learning strategy. The 43 students were in sixth grade and took a pretest. They were split into two groups to learn how honeybees used dancing to communicate. Starting, stopping, and rewinding the animation allowed the 6th-grade students to review information and in the case of the strategy treatment group, they were able to answer the strategy questions and take notes, while the second group wrote an essay on the topic. Next, the students took a posttest to determine student grasp of factual, conceptual, and procedural knowledge.

Based on the results, Kombartzky et al. (2010) decided that the use of the questioning strategy greatly impacted student achievement of conceptual and procedural knowledge of how honeybees used dance to communicate. The students who learned using the questioning strategy earned almost twice the score of the essay group on procedural knowledge, and approximately 20% higher mean scores on the conceptual knowledge portion of the assessment. The factual knowledge mean scores for both

groups were within 10% of each other, with the strategy group earning the higher score of over 76%.

Kombartzky et al. (2010) explained that less than 20% of the students in the strategy group took the notes and sketches outlined in the strategy employed in the study. Therefore, in a second study they sought to reproduce the previous results and to influence student completion of the strategy questions. A group of 154 students in the sixth grade were randomly assigned to the Essay group, Strategy group, or a Strategy group with Monitoring. As previously, the Strategy group outscored the Essay group but the scores of the participants in the Strategy group with Monitoring was greater than that of the other groups. The human monitors appear to influence the results for the Strategy group with Monitoring by cuing students back to the task at hand. Cues can be in the form of human monitors as well as be embedded in animations. Thus, the available findings on cued animations are discussed in the passages below.

The impact of cued animations on student achievement. Cues can take many forms and to determine if adding varying amount of cues to animation increased achievement, De Konig, Tabbers, Rikers, and Paas (2010) assigned 40 undergraduate participants to learn about the cardiovascular system by viewing animation with a single cue, multiple cues, or without cues. They expected that the addition of additional cues would help students focus on the more important information and therefore lead to better comprehension results on the post and transfer tests given later.

They explained that the saliency of the cues initially attracted the participants but their attention drifted shortly thereafter. According to De Konig et al. (2010), the participants who underwent the single cuing treatment reported more self-explanations

about the area of the animation that they were directed than did participants learning without the cued animations. In addition, increasing the number of cues in an animation did not contribute positively to the participant's ability to explain the cued parts of the animation. Cognitive load theory appears to support the findings. According to cognitive load theory, instruction in multiple modalities incites particular area(s) of the brain to attend to particular stimuli (McLoughlin & Krakowski, 2001; Pollock et al. 2002; Sweller et al., 1998).

In a 2005 study, Dwyer teamed with Owens (Owens & Dwyer, 2005) to investigate the effectiveness of animation, prompting, and cuing strategies on the learning acquired among 180 participants of low and high prior knowledge. In the first of three treatments, static cross-sections of the heart were given, along with visually animated support, when difficulty arose. The second group was prompted and cued to information to be learned by colored areas and verbal summations. In the last treatment condition, the participants could split attention between the static visual and an animated realistic colored version of the heart. Clicking on a practice button showed the heart processes and parts, which were not labeled on the static model. The researchers' findings lend credence to cognitive load theories that emphasize that an overload of information can thwart learning (Sweller et al., 1990; Sweller et al., 1998). Apparently, as the attention-getting stimuli and visual elaborating strategies increased, participant performance decreased (Owens & Dwyer, 2005).

Cognitive theorists believe that more is not always better in instruction because learners have to attend to more stimuli and split attention. For instance, the last treatment group could press a button to show the process and parts of the heart, thus requiring the

devotion of more working memory to the words and processes and separating learner attention from the static illustration to be learned. Owens and Dwyer (2005) explained that the added color and motion were overwhelming, especially for participants with low prior knowledge.

In a further study, Li and Grabowski (2006) attempted to discover if animation or static visuals were more effective instructionally. Of the participants, 58 were identified as having high prior knowledge, and 57 were categorized as having low prior knowledge. The control group was treated to instruction that combined the static visual and the verbal information on the same page. Meanwhile, the second group was exposed to attention-getting arrows and buttons such as “click to see the animation,” “continue,” “back,” and “next” directed toward the visuals. The final group was a combination of the treatment in the second condition and elaboration strategies that included pop-up windows and animated arrows to highlight important learning tasks.

Unlike other studies by Williams and Dwyer (2004) and Owens and Dwyer (2005), prior knowledge did not appear to influence the results of Li and Grabowski’s (2006) study. Li and Grabowski found that low and high prior knowledge students performed equally well under the three treatment conditions. Li and Grabowski believed that the side-by-side arrangement of the page, as advocated by Chandler and Sweller (1991) and Mayer and Moreno (2002), contributed toward greater learning gains for the low prior knowledge students. Sweller et al. (1998) explained that when learners have to divert attention from one area to another, the working memory is strained, and fewer cognitive resources are available to process the information effectively. The influence of the instructional design of animation on achievement is discussed below.

Overview of findings on the instructional design of animations. Ainsworth and Van Labeke (2004) and Hegarty (2004) indicated that animation can show change over time. Meanwhile, Wouters, Paas, and Van Merriënboer (2008) identified attention-getting features such as flashing arrows as another characteristic of animation. Rieber (1990) added presentation and practice as other features of animated visuals. These various animation characteristics can serve to split-attention as posited in the Owens and Dwyer (2005) study. Hence, instructional design features are important considerations when selecting animation for instructional purposes and also when determining the effectiveness of animation tools (Wouters et al., 2008; Mayer & Moreno, 2002). In the following sections the instructional design of animation will be discussed.

Ausman et al. (2008) investigated if adding prerequisite knowledge would aid in learning from animation. The 138 college students were separated into 3 groups. The control group received illustrations with verbal prompts and they could move forward or backward by clicking the electronic tools. In the second treatment, questions were added to emphasize important information. The third treatment group differed from the second treatment group because further animated sequences were added to progressively reveal additional information, pop-in verbal information, show motion, or to contract, or expand. Afterward the participants took a drawing, a comprehension, an identification, and a terminology test. The scores revealed that treatments 2 and 3 were superior to treatment 1 only on the drawing test. There were no significant differences among all treatments on the terminology and comprehension tests.

The findings from Ausman et al. (2008) indicate that cognitive load, or the instructional design features and other uncontrolled interference, is an important

consideration in instruction, but more so in especially complex or high intrinsic load learning situations (Pollock et al., 2002; Sweller et al., 1998; Van Gog & Paas, 2008). De Konig et al. (2010) explained that compromised learning can result from the multiple modalities of presentation that overload too many cognitive domains of the brain. In attempting to process multiple modalities of stimuli at the same time, information is missed or the learning is negatively compromised. In the Ausman et al. (2008) study, questions and further animated sequences were added but they did not appear to positively impact the overall achievement results.

In situations where learners lack prior knowledge, the instructional design format is considerate of the learner and is adjusted accordingly to ensure knowledge acquisition. (Clark & Paivio, 1991; Feldon, 2007; Van Gog & Paas, 2008). In review of the research, the discrepancy between Li and Grabowski's (2006) findings and that of Williams and Dwyer (2004) and Owens and Dwyer (2005), regarding prior knowledge, is significant when considering the formatting of instructional material. For instance, in the first treatment condition of the Owens and Dwyer study, the participants had to "back-up" or "move to the next frame or replay" to review information, while in the Li and Grabowski study the attention was not diverted to additional pages. These differences in the instructional design formatting of the animations could account for the differences in the findings from these studies.

A lack of attention to the instructional design features of animation could have significant ramifications for the use of animations in instructional settings. For instance, Rieber (1996) found mixed results after reviewing 13 empirical investigations on visuals enhanced with animation in computer-based instruction. Rieber determined that only five

of the studies resulted in significant findings for the benefit of adding animation enhancement to computer-based instruction. Likewise, Park and Hopkins' (1990) review of 25 studies comparing the effect of static versus animated visuals revealed that 11 of the studies did not lead to significant findings. Rieber's contention that the implementation of the research methodology could be flawed was also favored by Park and Hopkins as their rationale for the differences in the findings. More recent studies by Catrambone and Seay (2002) found significant results when animation was added to instructional material. However, Koroghlanian and Klein (2004) and Chanlin (2001) found that adding animation did not result in significant achievement.

Mayer and Moreno (2002) and Mayer (2005) proposed that flaws in the design of animated instruction could be another reason for the inconsistent results of research on animated visuals information. Therefore, Mayer and Moreno suggested several principles to be used with visuals enhanced with animation. They specified that narration should support animation enhancements rather than using the animation by itself. When narration is included, they proposed that such narration should be personalized, rather than formalized and that narration is superior to text in aiding understanding of animated content. However, Mayer and Moreno explained that if used, text information should be located close to the animation enhancement.

It should be noted that Mayer et al. (2005) also conducted a series of experiment to investigate how much information participants recalled and transferred after learning with static versus animated content. The results indicated that the participants who learned with the animated media never outscored those learning with the static version of

the content. In fact, of the 4 studies, all the significant differences were in favor of the participants learning with the static media (Mayer et al., 2005).

Unfortunately, the Mayer et al. (2005) study did not detail the characteristics of the animation involved in their experiments. For example, the researchers stated: “they viewed computer animation and narrative depicting how the toilet tank works” (p. 262). This non-specific description was generalized to all the experiments they conducted. Animation has numerous characteristics that impact the effectiveness of the message communicated.

For instance, in Li and Grabowski’s (2006) study the animation incorporated a number of attention getting strategies such as arrows, pop-up boxes, and windows. Apparently, in that study the animation design features were designed to work in a manner that was cognizant of effective instructional design principles and thus contributed to higher gains in the Li and Grabowski study. The proposed guidelines for effective multimedia include eliminating activities that obstruct learning (Wouters et al., 2008) and grouping picture and text in close proximity on the page (Mayer & Moreno, 2002). It could be assumed that the seven principles proposed by Mayer and Moreno (2002) were utilized in the Mayer et al. (2005) study and, therefore, implies that the animated visuals of the Mayer et al. study conformed to research best practices regarding the design principles of effective animation.

Summary

Highlighting and animation are only some of the tools that could scaffold the cognitive processes during learning. Vygotsky (1986) was an avid proponent of adding appropriate supportive agents to assist students to reach their full developmental

potential. However, Cognitive Load Theorists (Sweller et al., 1990) illustrated that flaws in the design of information can be detrimental to learning. According to the cognitive load theory (Sweller et al., 1990), redundant information should be avoided to prevent an overload of information in the learning process. Mousavi, Low, and Sweller (1995) explained that mixing visual with auditory information is one possible way to eliminate redundancy. According to the Depth of Processing Theory, giving the learner information does not lead to the depth of knowledge that can be acquired if learners have to locate or calculate the answer for themselves (Craik & Lockhart, 1972). The depth of processing theory is akin to automaticity Moors and De Houwer's (2006) and Clark and Paivio's (1991) concept that if the stimulus is automatically processed, then learning does not occur. A significant portion of available animations utilize visuals therefore relevant research on visuals will be discussed in the following sections.

The Impact of Visuals on Achievement

Over 30% of the brain's cortex is devoted toward processing visual information, while only 8% targets cognition of information that is felt. Most learners can read five times as fast as the average person talks and are able to register images in fractions of a second (Burmark, 2002). Research also indicates that over 60% of the population is strongest in the visual intelligence learning modality (Felder & Spurlin, 2005; Levie & Lentz, 1982; Silverman, 2002). In fact, most individuals have about 60,000 auditory nerve fibers for sending information to the cerebral cortex, and the eyes have a total of 2,000,000 fibers for sending visual information to the brain (Burmark, 2002). Consequently, visual communication can overpower the written or even the spoken word

(Burmark, 2002; Eco, 1979; Eisner, 1990; Hittleman, 1986; Lambert & Carpenter, 2005; McLoughlin & Krakowski, 2001; Piro, 2002; Stokes, 2001).

The imperfection of language as a substitute for visual is a firm belief held by Eco (1979). Words sometimes fail to succinctly express an idea and at times they can even communicate the wrong idea. Asking learners to think about an image to express “rose” and comparing what they imagined to a picture of “Rosie the riveter” elucidates the idea that words can fail to encapsulate what a picture could do in a single glance. In some cases, adding appropriate visual aids to instruction has revealed that learning can be improved by as much as 400% (Burmark, 2002). The following will discuss research findings on the impact of various visual combinations, the redundancy of visuals, and visual type and relevancy on achievement. The later sections are a discussion of the impact of visual format and prior knowledge on achievement. The last section is a summation of the literature reviewed.

The impact of various visual combinations on achievement. Velayo and Quirk (2000) hypothesized that recall rates would be higher for visual and text information combinations than for information presented by text or auditory only. A second hypothesis was that a higher recall rate would occur for paired concepts that utilized two modalities (in this scenario, one of the modalities was always visual) than under text and auditory conditions. The 324 participants observed a concept by visualizing pictures (visual), visualizing words (textual), listening (audio), or a combination (audio-visual, visual-textual, audio-textual) of all three modalities. Prior to tabulating the correct responses for the six groups, the groups identified the strategy they used to recall the concepts. The strategies were then categorized into these five areas: rehearsal-repetition,

memorization-listening, looking-reciting, word association-made sentences, visualization-imagery, and similarities between words-common attributes. The recall rate of the paired concepts was higher for audio-visual and visual-only participants than was the recall rate for participants exposed to the textual-audio modality condition.

Velayo and Quirk (2000) found that the recall scores for the audio-only modality condition were significantly lower than those in the visual-only modality, the textual-only modality, and the audio-visual modality conditions. The audio-visual and visual-only modalities yielded higher recall rates than those derived in the textual-audio modality. The participants who cited their use of word association, visualization, and finding similarity strategies also had higher recall rates for paired concepts than those participants who did not use a strategy or who were inconsistent in their use of strategies. Those participants exposed to the visual conditions and using the recall strategies of identifying similarities in the pairs and using word associations had higher scores than those that used the rehearsal strategy. Velayo and Quirk's findings showed that adding visuals to instructional yielded higher achievement than did traditional approaches utilizing only audio-textual presentation.

To investigate if students learned more when the information was strictly text-based or if they learned more when the information was in the form of diagrams, Ainsworth and Th Loizou (2003) devised two formats for the visual-textual material. The researchers also investigated if self-explanation helped students to learn more and if the students produced more self-explanations when they studied diagrams or when they studied text only. Finally, the researchers examined the benefits of self-explanation when learned from diagrams or text.

The results indicated that students learned more from the diagrams than they did from the written information. In the posttest, the participants had almost 4 more correct responses than they had during the pretest; whereas the text-only participant increased by 1 correct response. Those participants learning by diagrams answered 80% of the questions correctly, while the text learners answered 56% correctly. The implicit and explicit questions required written responses, which earned mean scores of 78% for diagram learners and 46% for text learners. The researchers expected that the diagram learners would encounter difficulty in transferring the visual information into words, but the scores revealed otherwise. According to the researchers, the diagram learners produced more significant self-explanations than those learning from text and actually spent less time on learning the concepts.

Ainsworth and Th Loizou's (2003) findings are supported by McKay's (1999) study. McKay reported that when novice verbal students were given information that combined text plus graphics that their scores increased from a pretest score of 12% to a posttest score of 55%, or a 42% increase from pretest to posttest. McKay also reported that although participants with high verbal knowledge posted the highest score, 67% on the posttest that the scores had only increased by 7% since the pretest and the treatment were undertaken. The scores of the students with lower verbal knowledge exposed to the text and graphics information surpassed the scores of their counterparts, showing an improvement of 42% versus 32% for the text-only low verbal knowledge students. The visual condition posed less cognitive load on the participants and they were able to recall more in less time because of the addition of visuals. If visuals are appropriately designed

and presented, the chance of recall could be higher than if verbal information is the only modality used in instruction.

To address the impact of visual formatting on student achievement, in a 2004 research by Williams and Dwyer a physiology pretest was administered to 53 study participants to assess their prior knowledge of the heart and its functions. The researchers investigated if the visual arrangement format on the test impacted retrieval of the learning objectives, if prior knowledge influenced the test results, and if prior knowledge was mitigated by the testing format. The content included 19 black-and-white visuals that incorporated arrows to focus learner attention. The visuals could be employed when the participants were unsure of the verbal instructions. The control group was instructed with visual materials but received verbal questions (verbal test format), the second group was treated to visual questions (simple visual test format); and the third treatment incorporated more realistic visuals to answer the questions (intermediate visual test format), while the final group received more detailed visuals for the test questions (detailed visual test format). Results indicated that the intermediate test format led to a narrowing of the gap between participants of high and low prior knowledge.

The knowledge gain occurred because the visuals on the test questions were identical to the type used during the instructional phase (Williams & Dwyer, 2004). Functionally, all the visuals were equal in helping participants to retrieve information and the results indicated that participants with high prior knowledge outperformed those with lower prior knowledge. Overall, the visual format did not significantly contribute to these results.

These results indicated that presentation of instruction in multiple modalities requires the use of more cognitive systems. For example, visuals use the verbal and the imagery systems, while textual information relies heavily on the usage of the verbal system of the brain (Lambert & Carpenter, 2005). As recall of information is elicited, information learned only verbally is dependent on a single system. On the other hand, information learned visually has a higher possibility of recall, and that recall is richer and more accurate (Hittleman, 1986; McLoughlin & Krakowski, 2001; Sibbet, 2008). The degree of alignment between visual and text content was the subject of the research that is discussed in the following paragraphs.

The impact of the redundancy of visuals on achievement. In their study, Reinking, Hayes, and McEneaney (1988) categorized the 7th and 8th-grade participants as poor readers (below the 35th percentile) and good readers (above the 35th percentile) based on their scores on the Metropolitan Achievement Test (MAT). The participants were given reading passages of 250 to 300 words that incorporated no graphic aids, graphic aids, no graphic aids and with either of three cue conditions. The 167 students were treated to the 3 expository passages which included graphic aids that were redundant to the text or to graphic aids that were non-redundant to the text. The redundancy of the graphic meant that the information it provided was repeated in the text, while the information in the non-redundant graphics was not clearly stated in the text. The students were also exposed to conditions with: (a) no graphic aids accompanying the text, (b) specific cues to the graphic, (c) no cues, (d) general visual cues, or (e) a combination of cue types.

Reinking et al.'s (1988) study indicated that subjects exposed to the different cuing conditions had greater information recall than did subjects who had no visual cues. In all the treatment conditions, the good readers outperformed the poor readers on the recall of information. However, when the visuals were specifically cued, the recall difference between poor and good readers was reduced. In fact, the research data indicated that explicit cuing was more advantageous to poor readers than they were to good readers. The researchers hypothesized that poor readers relied more on cues to increase the attention they devoted to visual information in order to understand written text. Reinking et al. also pointed out that if visuals are immersed in the text and specific

cues in the written information point to the visuals that learners' recall rate will be higher than if the cue is general or absent from written text.

The redundancy of presentation, as evident in the visual and verbal condition, was possibly mediated by the addition of cuing. Integration of redundant information is a solution suggested by Sweller et al. (1990) to alleviate cognitive overload. Therefore, the positioning of verbal information and cues alongside the redundant visual saved working memory space because the participants did not have to split their attention to other information on the page or elsewhere outside the page to learn the information.

Cognitive Load Theory (Sweller et al., 1990) illustrates that redundant information, such as the diagrams in this research, often can be detrimental to learning. The researchers believed that the diagram actually helped to explicate the information, thus fostering greater recall. The dual coding theory additive effect hypothesis also supports the addition of visuals to text as a way to increase recall (Paivio, 1971). Therefore, the importance of visuals as learning and instructional tools is highly dependent on the type of visual that is incorporated as well as the type of question to be answered. If the match between the visual, text, and question type is inappropriate, the learning that will be realized could be greatly reduced for some learners. The visual type and its relevancy to content and learning objective were emphasized in the literature that is reviewed in the pages that follow.

The impact of visual type and relevancy on achievement. In research to determine the effectiveness of the types of visuals added to textual information, Hurt (1987) divided 20 students into 2 treatment conditions. In the first condition, one group was given a passage that incorporated an analogical visual description, and the second

group was given the same reading passage but included a visual that literally translated the textual information. After reading the passage, each group answered 10 questions that were related to the passages. In a subsequent meeting, the groups were given another passage, but the visual treatment conditions were switched between the groups.

The resulting data detailed the importance of fitting question type to the illustration type because optimally visuals should be suited to the type of question to be asked (Hurt, 1987). The literal or analogical nature of the questions, in relation to the type of visual representation, significantly influenced the results. Some questions that referred to abstract concepts were correctly answered with the addition of the analogical visual. However, the participants who answered the questions on the text that were literally visualized answered fewer correct questions. The participants who read the text with the enhancement of a literal visual answered more questions correctly that were of a literal nature than did those subjects who used the analogical visualized text.

McGrudden, Schraw, Lehman, and Poliquin (2007) conducted a similar experiment to Hurt's (1987) to gauge the recall of causal information when a causal diagram or only textual information was utilized. McGrudden et al. reported that 70%, or .26 versus .15, more information was recalled when the diagram was combined with the textual information than when only the text information was used. The appropriate matching of the textual information with the appropriate diagram also facilitated greater recall of the relevant information.

Tlauka, Keage, and Clark (2005) found that distinct areas of the brain were activated depending on the type of visual information studied. The researchers explained that more activation was evident in the right medial hemisphere when the participants

studied from the visual model of a map than was the brain activation observed when the participants read a description of the map. This finding supports the theory that visual processing is modality specific. Dual coding theory (Paivio, 1971) also indicated that visual and verbal information are processed by distinct channels of the brain. The laying down of a distinct cognitive memory for visual information implies that visuals should be incorporated in instruction to increase learning potentials.

The ability to transfer learning to other areas is a critical component of future success. Many students are not exposed to learning situations that fully develop their skills to embark on future pursuits such as correctly interpreting contour maps. Taylor, Renshaw, and Choi (2004) explored whether or not the format of contour maps impacted comprehension, whether or not multiple formats would increase a learner's interpretation of contour maps, and whether or not the knowledge learned about contour maps was transferable to other areas. Taylor et al. randomly assigned 53 students to practice with two-color maps, a colored map, and then a black-and-white map; a black-and-white map followed by a colored map; or two black-and-white maps. The results indicated that the participants exposed to the colored maps had more response accuracy.

Verdi, Stamm, Johnson, and Jamison (2001) assessed the impact of map color and information location on learning. In the first condition, the participants were exposed to a map with a dark or a lighter colored border with features on the border or within the map. In the second treatment, the students received either a map with features on the border or with the features inside the borders of the map. The lightness or darkness did not significantly impact the results. However, when the features were located along the edge of the map border, the students had greater recall than when the features were located

within the map itself. The implication is that map design is a critical component in determining the functionality of visuals used in instruction.

According to the Cognitive Load Theory (Sweller et al., 1990), redundant information should be avoided to prevent an overload of information. However, the Verdi et al. (2001) finding contradicts the position held by cognitive load theory that redundancy should be avoided. For example, Mousavi et al. (1995) explained that mixing the visual with auditory information is a possible option to eliminate redundancy. However, in the Verdi et al. study, both maps were presented visually. Therefore, it appears that under certain conditions, the redundancy of the information could be suitable. In the Verdi et al. study, recognition and recall of contour was important and could be deepened by viewing maps that showed different spatial configurations of the contours to be learned. The different spatial representations of the map contours and in colored differentiation of contours possibly led to further extrapolation of the map configuration and greater recall.

Summary

Research that compares the information that is learned when using visualized material and what is learned when using non-visualized material points to the value of visuals in communication (Angeli & Valanides, 2004; Eisner, 1990; Fischman, 2001; McLoughlin & Krakowski, 2001; Paivio, 1971). Researchers have found that interest, attitude, enjoyment, and emotions were impacted by the use of visual content. Most important, the research findings emphasized that the subjects who are exposed to visuals during learning often performed better on measures of achievement.

Knowledge Models

Assessing knowledge acquisition requires assessment engines that can be employed reliably and consistently to ensure attainment of the learning objectives. Bloom's Taxonomy of Educational objectives is often utilized in educational settings to assess educational achievement (Darling-Hammond & Bransford, 2005). Consequently, in the next sections, Bloom's Taxonomy as well as the International Center for Leadership in Education Rigor/Relevance Framework will be discussed due to their applicability to the research undertaking.

Bloom's Taxonomy

Bloom (1956) emphasized that learner experience mattered and his early work focused on the cognitive, affective, and psychomotor spheres of knowledge. The learner attitudes and feelings resulting from the learning task were attributed to the affective domain, while the learner manipulative and physical ability were classified under the psychomotor knowledge realms. The adaptation of Bloom's ideas into K-to-12 assessment practice draws mostly from his ideas regarding the cognitive realm of knowledge.

How the learner processed the information learned and how they applied the knowledge acquired relates to the cognitive area of knowledge. Bloom (1956) proposed that knowledge can be differentiated across a continuum and that the values differed based on their location on the spectrum. Thus, knowledge could be categorized and measured based on its assigned value on the continuum. Bloom's Taxonomy added reliability to the assessment of achievement and instructional practice. The Taxonomy

allows evaluation of the task to be learned and it provides a structure in which the learning objective can be substantiated.

The Taxonomy is structured along a gradient beginning with knowledge at the lowest level, followed in ascending order by comprehension, application, analysis, synthesis, and ending with evaluation as the highest level of knowledge attainment (Bloom, 1980). The recall of specifics, such as dates, identifies the lowest level of the Taxonomy. Comprehension, the second level, is characterized by processing of information at a low level such as exemplified by restating information. Demonstrating knowledge at the application or third level could involve using a mathematical formula correctly to solve a problem, while identifying the components of a chemical reaction could be classified as evidence of knowledge at the fourth or analysis level. Knowledge at level 5, synthesis, involves the combination of varying ideas or concept to make an accurate whole. Meanwhile, an example of knowledge at the highest, evaluation level would be demonstrated by the ability to forward judgments about a technique or result by proposing how and why it was unsuccessful or not (Bloom, 1956).

As the level of knowledge increases, the time involved to process and react to the task also increases incrementally. After reading about *America's Declaration of Independence*, a learner could quickly restate the date of independence. If the learner is asked to evaluate the effectiveness of the U.S. Constitution's system of checks and balances, then more time is required for the learner to think about the various components and determine their effectiveness and then express their response. In comparison to the previous question, the second is more in depth in terms of the cognitive processing

demands because information has to be recalled, comprehended, analyzed, and judged prior to an appropriate response.

The steps involved in the second task could then be evaluated by the instructor to gain a greater degree of consensus about the inherent difficulty of the task (Bloom, 1980). Subsequently, the types of questions that are asked implied the level of cognition demanded by the task. Thus, key words such as who, what, when, and where became synonymous with the lowest level of knowledge questioning, while questions beginning with words such as compare, categorize and examine were commonly associated with higher levels of knowledge inquiry.

Consequently, instructors were able to use Bloom's Taxonomy to frame the formulation of objectives and concurrently identify the cognitive difficulty that a task imposed upon the learner. Over time, Bloom's Taxonomy of Educational Objectives has undergone various adaptations. The following sections will discuss the International Center's for Leadership in Education Rigor/Relevance Framework.

Rigor/Relevance Framework

Daggett and Nussbaum (n.d.) of the International Center for Leadership in Education drew upon the landmark neurogenesis study of Eriksson, Perfilieva, Bjork-Eriksson, Alborn et al. (1998) to adapt Bloom's Taxonomy. Eriksson et al.'s findings revealed that new brain cells could be regenerated in the hippocampus. Their findings contested previous understanding that the brain was rigid and unable to reproduce new cells. According to the International Center for Leadership in Education socialization, physical activity, and mental stimulation were some of the most important criteria of an enriched educational setting. The area of mental stimulation is of most value to the

research and will be discussed in relationship to how the International Center for Leadership addressed Bloom's Taxonomy.

Daggett (2005) recommended the provision of novel and complex instruction because it promotes a healthy brain and as the educational enrichment increases, so does the brain's synaptic connections. To achieve this aim he developed the Rigor/Relevance Framework. Touted as higher than Bloom's Taxonomy, the Rigor/Relevance Framework can define complex thought as well as the application of knowledge on any given learning task. To achieve this ability, the Rigor/Relevance Framework employs a vertical and a horizontal line that each start at the same point, before branching out horizontally or vertically.

Starting at the lowest point on the vertical line, Bloom's Taxonomy of Educational Objectives is arranged from the lowest to the highest level of knowledge. The vertical line is labeled "knowledge." Along the horizontal continuum line is arranged the adaptations suggested by Daggett (2005). The horizontal continuum line describes the five levels of application that are possible at each knowledge level of Bloom's Taxonomy. The horizontal "application" line begins with "Knowledge in one discipline," the lowest level of application; the next level is "Apply knowledge in one discipline"; followed by "Apply knowledge across discipline"; then "Apply knowledge to real-world predictable situations"; to finally, "Apply knowledge to real-world unpredictable situations."

The dimension of the Rigor/Relevance Framework is further divided into quadrants. The lowest two quadrants, reading from left to right, are labeled "A" for Acquisition and the second is labeled "B" for Application. The top two quadrants,

reading left to right are labeled, “C” for Assimilation and the next is labeled “D” for Adaptation.

In designing instruction, Daggett (2005) advised that instructors should design instruction and assessments to target the skills in quadrant “D” or the adaptation quadrant. Instruction in the Acquisition quadrant is characterized by teacher talk and work; if knowledge at the Application level of the quadrant is sought, the learner should be engaged in practical real-world activity. In quadrant “C,” tasks that call for creation and evaluation should be observed, and at quadrant “D,” student-centered learning is evident. Daggett (2005) explained that Quadrant “A” knowledge has to be acquired before attainment of either “B” or “D” knowledge is possible because they both give the Quadrant “A” learning depth and applicability.

Daggett (2005) added that Quadrant “A” knowledge is assessed on most state tests utilizing multiple-choice questions. Meanwhile, Quadrant “D” questions would require more time to complete and to grade. In addition, Quadrant “B” and “D” knowledge requires a cross-curricular approach in order to be attained.

The International Center for Leadership in Education Rigor/Relevance Framework provides a different model by which academic achievement can be measured. Bloom’s Taxonomy employs a fairly linear perspective of knowledge, while Daggett expounds on the dimensions on which knowledge could be assessed. Daggett of the International Center for Leadership in Education emphasized the importance of instruction that is geared toward the attainment of applicative knowledge. Therefore, a student can learn a fact and be able to apply it at the lowest level by simply knowing the fact in a single discipline or they might be able to apply the factual knowledge to real-

world unpredictable situations. The adaptation of Bloom's Taxonomy demonstrated the wide variations in how knowledge could be viewed and assessed.

Summary

The literature reviewed revealed that the use of highlighting and animation tools affected the achievement of students differently due to factors such as prior knowledge and previous academic achievement. Clearly, more research on the use of highlighting and animation tools during reading is needed when considering the overall educational effectiveness of these tools at the K-to-12 levels.

National testing data and graduation rates clearly demonstrate the achievement gap. When learners lag academically, the cycle of failure continues and many students drop out of school. Vygotsky's (1986) theory of how learners construct knowledge elucidates the critical importance of incorporating effective measures that will support cognitive growth. He also stressed that students have a wide swath of cultural and social experiences that significantly impact their learning readiness (Byrnes, 2001). Therefore, if students begin school behind their peers, then appropriate cognitive support should be employed to aid their academic development.

Technology offers many educational support tools but the Cognitive Load Theorists emphasized that the design features, the task, and the learner's prior ability and achievement are important considerations to be applied when selecting instructional supports. Overall, none of the current research discussed or available focused on the actual highlighting and animation tools in the electronic resources used in instructing K-to-12 students. However, the previous research discussions indicated a clear over-reliance on textbook content by teachers and students (Hawkins et al., 1998) and that highlight

and animation could benefit learners. Therefore, a close examination of the highlight and animation tools in electronic textbooks could add to current understanding of their instructional effectiveness.

CHAPTER 3

METHODOLOGY

In this chapter the data analysis methods are described. The chapter also addresses the demographics of the study population. In the latter sections, the sampling methods, procedures, instrumentation, and the methods of statistical analysis are described.

Research Questions

This research explored how student use of the highlighting and animation tools in an eEdition World History textbook, while reading, impacts student achievement on a World History test.

The research questions are:

1. How does the use of the electronic edition (eEdition) World History textbook highlighting and animation tools relate to the knowledge and comprehension achieved by students on a World History test of knowledge and comprehension?
2. Are the effects of the eEdition World History textbook tools of highlighting and animation moderated by student Scholastic Reading Inventory (SRI) level?
3. What are students' perspectives on using the highlighting and animation eEdition World History textbook tools while reading World History content?
4. What are teachers' perspectives on using the eEdition World History textbook highlight and animation tools in instruction?

Design of the Study

The study focuses on student use of highlighting and animation tools in an electronic edition (eEdition) World History textbook to determine how their use impact student achievement of knowledge and comprehension. The study used two versions of *World History: Patterns of Interaction* (Beck et al., 2005) a textbook that is used to teach world history to students in tenth grade. The estimated lexile measure of the book is 1060. The Electronic Edition (eEdition) is a version of the World History textbook and the traditional World History textbook is a second version.

The conditions designed for the study were: (a) Highlight, (b) Animation, (c) Highlight-and-Animation, and (d) Comparison. The Highlight, Animation, and Highlight-and-Animation conditions used the *World History: Pattern of Interaction* eEdition textbook during all phases of the study. The Comparison group used the traditional version of the *World History: Pattern of Interaction* textbook. The Comparison group served as the contrast against which the effectiveness of the eEdition World History textbook conditions was assessed. The study used the World History textbook because it has a traditional edition and an electronic edition.

The eEdition of the World History book is the online version of the traditional World History book, but certain content can be augmented with animation or highlighting. The animation is accessible by clicking and using the respective tools to stop, start, or pause an animation; clicking the highlight button and dragging the cursor allows highlighting of targeted information in yellow. The study focused on student use of highlighting and animation tools in the eEdition World History textbook to determine how their use impacted student achievement of knowledge and comprehension of World

History content. The eEdition textbook and the traditional textbook allowed comparison of the achievement results of students after using each version of the World History textbook.

All the study participants read the unit *Societies and Empires of Africa* from the *World History: Pattern of Interaction* textbook. The unit was divided into three sections. The first section was *North and Central African Societies*, the second was *West African Civilization*, and the third was *Eastern City-States and Southern Empires*. The estimated lexile measure of each unit is 1060.

Guided reading questions were used by all the participants. The *World History: Societies and Empires of Africa* Guided Reading Questions (Appendix E) were adapted from the questions in the student edition of the *World History: Pattern of Interaction* textbook. The *World History: Societies and Empires of Africa* Guided Reading Questions were divided into three sections. The sections were *North and Central African Societies Guided Reading Questions*, *West African Civilizations Guided Reading Questions*, and *Eastern City-States and Southern Empires Guided Reading Questions*. The guided reading questions were used with the so named respective World History reading topics.

Subjects and Setting

The subjects of the research were 82 students who were enrolled in a regular World History course and two teachers of regular World History. The participants were situated at an urban high school in in the South Eastern United States. According to statistical data published by the U.S. Census Bureau, more than 60% of the city's residents were White and more than 25% were Black, while the remaining residents were other ethnicities (U.S. Census Bureau, 2007). The U.S. Census Bureau also approximated

the median household income of the city at \$43,371 and the per capita income at \$29,350. In 2009, it was estimated that almost 12% of the city's residents were living below the poverty level (U.S. Census Bureau, 2007).

Since the 2006 through 2007 school year the school's student population has remained between 2,300 to 2,500 students (FLDOE, 2008). Of the school's student population, approximately 29% were White, 50% were Black, 10% were Hispanic, and 11% were Others. The study site was chosen based on the students' achievement patterns, as evidenced by the rates of students who graduated, dropped out of high school, and gained proficiency on the Reading section of the Florida Comprehensive Assessment Test (FCAT).

The percentage of students who graduated within 4 years of entering the ninth grade was used as the criterion for determining the graduation rate, while the number of students who dropped out of school and did not enroll in another institution to gain graduation status was used for determining the drop-out rate. The graduation rate for the state, the School District, and the study site for school year 2005 to 2006 also included recipients of a diploma earned by undergoing a General Education Diploma (GED) Exit Option program. Students who earned special diplomas were counted as non-graduates (FLDOE, 2007b).

In 2006 to 2007 the FLDOE reported that almost 70% of students graduated within 4 years of entering ninth grade, while 3.3% dropped out of high school. The graduation rate for the school district during this period was .3% less than the percentage rate posted for the state. Meanwhile, the district's drop-out rate was higher, at a rate of 4.4%. In comparison to the 66 other school districts, the school District is ranked 35th,

based on the state's drop-out rate for 2005 to 2006 and 51st in terms of the state's graduation rate (FLDOE, 2007b).

In comparison to the district, in the 2006 through 2007 school year, the drop-out rate at the study site was 1.7% and their 4-year-graduation rate was 67% (FLDOE, 2007b). The data indicated that the study site had a lower graduation rate at 67%, at the end of the 2006 through 2007 school year, than did the state or the district graduation rate. However, the drop-out rate of the study site is lower, 1.7%, versus a rate of 3.3% and 4.4% respectively for the state and the district.

The school was chosen because the school's reading FCAT "at proficiency" and graduation rates indicated that over 60% of students were reading "below proficiency" and that performance on the FCAT test is linked to achievement of graduation. The FCAT measures student academic achievement of state standards in reading, mathematics, science and writing (FLDOE, 2007b). The FCAT reading achievement levels can fall into 1 of 5 categories ranging from Level 1, the lowest level, to Level 5, the highest level. In order for reading scores to count toward graduation, high school students had to earn a minimum of Level 3 or 1926 points on the Reading FCAT (FLDOE, 2007a). Students who scored at or above Level 3 on the FCAT Reading test are considered "at proficiency" and those who score below a Level 3, on the FCAT Reading test are identified as "below proficiency" and are unable to graduate unless they passed alternative assessments.

The School Improvement Plan (SIP) of the study site revealed that only 43% of the students scored at or above grade level on the 2008 FCAT reading (FLDOE, 2007a). This score was down from 44% on the previous administration of the FCAT reading test.

In comparison, 60% of the students in the district and the state gained proficiency on the reading FCAT. The NCLB School District and State Public Accountability Report of the study site indicated:

Although Whites improved minimally, all other subgroups went down. All the subgroups except Whites scored below the goal of 58% reading on grade level. Consequently, (school name deleted) did not make adequate yearly progress. This is an indication that additional interventions must be used to enable these students to succeed. (p. 7)

The lack of achievement posted on the 2007 Reading FCAT indicated the presence of a large number of low achievers who could help to determine the effectiveness of the eEdition World History textbook highlight and animation tools on student academic achievement.

Sampling Method

The students in “regular” World History classes were chosen from the 10th-grade students at the study site. Table 1 show the condition assigned to the 4 “regular” 10th-grade World History classes and the type and number of participants in each condition. All the regular classes were purposely selected because they contained a higher number of students with low FCAT reading proficiency than did the FCAT reading proficiency scores of the students in the “honors” and “advanced placement” 10th-grade World History classes. The study was intended to investigate if the addition of highlighting and animation impacted achievement and if prior reading ability influenced the results of the conditions. Therefore, the regular classes were ideal for investigating the effectiveness of the conditions and for determining if prior reading ability influenced the achievement

results. The conditions were randomly assigned to the classes. A regular World History class was assigned to each condition.

The qualitative portion of the research relied on data generated from 4 focus group interviews as shown in Table I. Students comprised 3 of the focus groups. The 6 members of each Student Focus Group were randomly selected from each of the eEdition conditions to participate in each Student Focus Group Interview. All World History teachers at the study site were selected for participation in the Teacher Focus Group Interview for a total of a 2 members in the Teacher Focus group.

Table 1

Study Conditions, Participants, and the Number of Participants

Condition	Participants	No. of Participants
Highlight	Students taking “Regular” World History	24
Animation	Students taking “Regular” World History	18
Highlight and Animation	Students taking “Regular” World History	19
Comparison	Students taking “Regular” World History	21
Student Focus Group Interview	6 students from each of highlight, animation, and highlight-and-animation group	18
Teacher Focus Group Interview	Teachers of “Regular” World History	2

Instrumentation

The first instrument, *World History: Societies and Empires of Africa Pretest* (Appendix D) comprised 36 multiple choice knowledge and comprehension questions.

The second instrument, *World History: Societies and Empires of Africa Posttest* (Appendix F), included the same questions. The *World History: Societies and Empires of*

Africa Pretest functioned as the covariate. The *World History: Societies and Empires of Africa Posttest* functioned as the gauge of the knowledge and comprehension achieved after the participants underwent the study.

The questions on the *World History: Societies and Empires of Africa Pretest* and the *World History: Societies and Empires of Africa Posttest* instruments were identified as knowledge or comprehension questions by using Bloom's Taxonomy (Bloom, 1980). The knowledge level of the Taxonomy is identified by the recall of specific information such as names and dates. The comprehension level is the processing of information at a low level, such as the restatement of information.

The third and fourth instruments were the *Student Focus Group Interview Protocol* (Appendix G) and *Teacher Focus Group Interview Protocol* (Appendix H). The fifth instrument was the SRI. The SRI test was not administered during the study but the participants' most recent SRI Lexile score was categorized as "at-grade-level," "above-grade-level," or "below-grade-level" to determine if SRI levels moderated the effectiveness of the conditions of Highlighting, Animation, or Highlight-and-Animation.

Procedures

After obtaining Institutional Review Board (IRB) approval from Florida Atlantic University, IRB approval was granted by the Research and Evaluation department of the school District. The participants in the study were purposively drawn by requesting participants from students who were in the tenth grade. The researcher distributed the Child Assent Form (Appendix A) and the Parental Consent Form (Appendix B) and study participants included all students who returned forms signed by their parent or guardian. The social studies teachers were asked to participate and given a Teacher Consent Form

(Appendix C) and the teachers who signed and returned the form were included in the study.

The student participants' most recent Scholastic Reading Inventory (SRI) Lexile score was gathered from school records. The SRI scores ranges from 200-1700. The scores were categorized into "at-grade-level," "below-grade-level," and "above-grade level." The participants underwent the condition assigned to their regular World History classes. Approximately 20 to 30 students were in each class and the class sessions were 100 minutes long.

The 36-item paper and pencil multiple choice *World History: Societies and Empires of Africa Pretest* was given to each group to determine student knowledge and comprehension prior to taking the condition. The participants had 1 hour to complete the test by circling the letter A, B, C, or D that corresponded with their answer choice. All the participants took the same pretest. After an hour the tests were collected and the students dismissed. The pretests were hand-scored to identify student knowledge and comprehension of the content.

In the next part of the study each eEdition condition received 20 minutes of training and then practiced for 1 hour to use the tool(s) assigned. The training included an overview of the eEdition tool(s) designated for the training group and then the group practiced using the tool(s). The content used for training and practice was selected from the eEdition World History textbook content that was not used in the study. The participants in the eEdition conditions were given a username and password to use during the study to access the eEdition World History textbook.

After training and practice, the eEdition conditions read the designated eEdition World History textbook content over three sessions. During each session the participants answered guided reading questions. As the eEdition conditions, during each 50-minute session, the Comparison condition read and answered the same guided reading questions.

The Highlight group was instructed to answer the guided reading questions by highlighting the information that supported answering the question and then to write their answer in the space below the question on their guided reading worksheet. The Animation group was instructed to use the animation tools to complete actions such as playing, pausing, or replaying the animation, and then to respond to the guided reading questions. The Highlight-and-Animation group received the combination of the instructions provided to the Highlight and the Animation groups. All conditions were instructed to answer the questions during or after reading, and that they could return to change or review answers to the guided reading questions if time allowed.

All of the participants worked independently, but during each session teachers circulated to assist students with questions about navigating or using the eEdition textbook and signing-on and signing-off the eEdition textbook with their username and password. The teachers also assisted the Comparison group by answering questions about the content. After 50 minutes the guided reading questions were collected and students took the posttest.

The subjects were instructed to circle the letter A, B, C, or D that corresponded to their answer choice on the posttest. The participants were allotted 60 minutes to complete the test. The students who completed the test before the time elapsed were instructed to review their answers or to sit quietly until everyone was finished. The tests were

collected at the end of the time and students were dismissed. The procedures were repeated for all conditions and for all parts of the posttest.

Four focus group interviews were conducted to identify teacher and student opinions about the use of the eEdition textbook highlight and animation tools. Three Student Focus group comprising six participants who were randomly selected from each eEdition condition was formed. A fourth focus group interview included two World History teachers.

Prior to the start of the focus group discussion, the students and the teachers were informed that all information shared would be kept confidential and identities confidential by utilizing pseudonyms. The researcher defined the meaning of a pseudonym by providing examples such as aliases. The student focus groups were informed that the results were strictly intended to add to current research and instructional understanding of how the use of highlighting and animation tools impacted achievement. Student and teacher permission was requested to audio record the proceedings. The series of questions and follow-up probes was used to gain the participants' feedback about the tool(s) they were assigned.

The Highlight, Animation, and Highlight-and-Animation Student Focus Group interviews occurred a day after the posttest was administered. The selected participants, from each of the eEdition condition, met with the researcher for 60 minutes to discuss their opinions on using the tool(s), what influenced their experiences, the possible difficulties they encountered, their suggestions for improvement, and their overall opinion on the instructional effectiveness of the tools. After completion of the student focus groups interviews, the teacher focus group interview was conducted. The Teacher

Focus group interview addressed teachers' views on students' using the eEdition highlighting and animation tools, the accessibility of the tools, and the participants' views on the overall value of the eEdition tools in aiding student achievement.

Variables

The independent variable was the condition that included the categories of Highlight, Animation, Animation-and-Highlight, and Comparison. The dependent variable was achievement on a World History test. The test questions were divided into 2 categories, knowledge and comprehension. The students' SRI Lexile levels ("at-grade level," "above-grade level," and "below-grade-level") were the moderators.

Reliability

A coefficient alpha was calculated to gauge the internal consistency reliability of the *World History: Societies and Empires of Africa Pretest* and the *World History: Societies and Empires of Africa Posttest* instruments. A reliability of .78 was obtained for the pretest instrument and a reliability of .77 was obtained for the posttest instrument. The multiple-choice instruments contained four possible choices, A, B, C, or D, for each item.

Validity

To obtain content validity, the Index of Content Validity (CVI) was used. An ordinal Likert-type scale provided 4 possibilities for each item. For each item, the choices include 1= *not relevant*, 2= *somewhat relevant*, 3= *quite relevant*, and 4= *very relevant* (Wynd, Schmidt, & Schaefer, 2003). The results were categorized into two groups so that items rated as *not relevant* or *somewhat relevant* were considered "content invalid" and the others as "content valid" (Lynn, 1986).

A panel of four state certified K-to-12 social studies teachers determined the representativeness and clarity of each item as well as how comprehensively the instrument covered the domain (Grant & Davis, 1996). The level of interrater agreement was calculated for items designated as “content invalid” and “content valid” before determining content validity (Grant & Davis, 1997).

To determine the content validity of the pretest and posttest instruments, the proportion of experts who rated each item content valid (I-CVI) and the ratio of items rated 3 or 4 by all the panel members (S-CVI/ave) was calculated. The content validity for each item (I-CVI) was computed by adding the number of experts who rated an item 3 or 4, then dividing by the total number of experts (Lynn, 1986; Polit & Beck, 2006). If 3 of 4 experts rated an item at level 3 or 4, the I-CVI is .75. An item content validity (I-CVI) rating over .70 was sought and an I-CVI of .75 was achieved for the pretest and posttest instruments.

The scale-level content validity index, average calculation method (S-CVI/Ave) was used to average the proportion of items the experts rated as relevant. The value was determined by adding the I-CVIs of the number of items rated 3 or 4 and then dividing by the total number of items. A matrix is used to show the items to be analyzed along the vertical axis and each expert is listed along the top of the matrix. An “X” identified rating agreement of 3 or 4, for each item, among the raters in the appropriate spot of the matrix, and no “X” would signify lack of relevance for an item. A rate of .80 was sought with the S-CVI and a S-CVI of .90 was achieved.

Scoring Method

Each correctly answered knowledge or comprehension question on the pretest and posttest instruments earned a single point. Incorrect responses earned no point. Evidence of increased achievement was measured by a positive change in a student score from their pretest score to their score on the posttest. Each participant received a knowledge and a comprehension score for the World History pretest and posttest.

The data from the focus group interviews were coded to get the overall student and teacher opinions on the use of highlighting and animating tools. The codes were developed after the transcripts were analyzed.

Statistical Techniques

A mixed-methodology comprised of quantitative and qualitative data was utilized in conducting the study. The quantitative and qualitative analysis methods are discussed respectively in the following sections.

Quantitative analysis. The study used four conditions: (a) Highlight, (b) Animation, (c) Highlight-and-Animation (combination), and (d) Comparison (traditional World History textbook). Student participants were given a pretest and a posttest. The pretest was used as a covariate in addressing research questions. The pretest and posttest each yielded two scores, one for the comprehension and the other for the knowledge questions. The results of the *Societies and Empires of Africa* pretest and posttest was analyzed using One-Way ANCOVA and Factorial ANCOVA statistical methods.

A One-Way ANCOVA that used the four conditions of: (a) Highlight, (b) Animation, (c) Highlight-and-Animation, and (d) Comparison was used to determine if the use of the eEdition World History textbook tools of highlighting and animation tool

was related to the achievement scores. A per-hypothesis Bonferroni adjusted alpha of .025 (.05/2) was used for the two dependent variables, knowledge and comprehension, derived from both the pretest and posttest. Each question provided two hypotheses. A test of the homogeneity of regression slopes, inherent in ANCOVA, was conducted.

A Factorial ANCOVA methodology was utilized to analyze the results achieved by the Highlight, Animation, Highlight-and-Animation, and the Comparison condition on the *Societies and Empires of Africa* pretest and posttest to assess if the results obtained were moderated by student SRI level. The conditions of: (a) Highlight, (b) Animation, (c) Highlight-and-Animation, and (d) Comparison and the trichotomized students' SRI scores of: (a) "at-grade level," (b) "below-grade level," and (c) "above-grade level," were used in a 4X3 Factorial ANCOVA to address whether the effect of the conditions was moderated by SRI level.

The participants with SRI Lexile scores below 1000 were categorized as "below-grade level." The SRI Lexile scores between 1000 and 1100 were categorized as "at-grade level," and SRI Lexile scores above 1100 were categorized as "above-grade level." The pretest was used as the covariate and a Bonferroni adjusted alpha of .025 was used to address the dependent variables of knowledge and comprehension.

Qualitative analysis. During the focus group interviews, notes were taken and after rereading the notes further notes and memos were taken to identify possible categories, themes, and relationships. Coding and connecting strategies were used to analyze the qualitative data. Maxwell (2005) explained: "Reading and thinking about your interview transcripts and observation notes, writing memos, developing categories

and applying these to your data, and analyzing narrative structure and contextual relationships are all important types of data analyses” (p. 96).

An open exploratory coding strategy was used to classify the data into themes based upon review of the audio recording and the notes taken during the focus group interviews. The coded themes were used for discerning possible within-group and between-group differences or similarities of the student focus groups. The explicit comparison strategy (Maxwell, 2005) was used to compare the overall (broad) response of each student focus groups to the interview questions. The comparative method identified the opinions that most characterized the processes of learning with the eEdition World History textbook tools for each group due to its applicability to homogenous groups. The opinions associated with each group were then compared to pinpoint any between-group differences in using the conditions.

The transcript from the teacher focus group was used to identify teachers’ opinions on the instructional effectiveness of the eEdition World History textbook highlight and animation tools. The data were coded by using the open exploratory method. The codes developed aided in identifying the prevailing themes that characterized the teacher’s opinions on the effectiveness of the textbook tools.

The data analysis for each focus group reflected the strategy of relaying data to include verbatim responses that were representative of each group. The credibility and authenticity of the data were established by using descriptions that helped the reader to place themselves in the experience or to gain a more sensory understanding of the group experiences in using the conditions (Creswell & Miller, 2000) and the differences that may arise based on their experiences. Therefore, the narrative depended on including

appropriately elaborated descriptions that were in-depth and detailed. The data were then compared to identify possible differences between the groups.

Summary

The study to investigate how the use of eEdition tools impact student achievement was undertaken at a high school in the South Eastern United States. A mixed methodology was employed to analyze the data. The quantitative portion utilized a One-Way ANCOVA and a Factorial ANCOVA. The data from a combination of student and teacher focus group interviews were categorized into themes to assess the qualitative information.

CHAPTER 4

RESULTS

The chapter is an analysis of the results of the study to determine the impact of electronic textbook tools on student achievement in World History. A mixed methodology was used and Table 1 contains the data sources utilized in addressing the research questions. The quantitative results are discussed in the first section of the chapter and the last section addresses the qualitative results.

Table 2

Data Sources Utilized in Addressing the Research Questions

Research Questions	Data Sources				
	Focus Group Interviews		Tests		Reading Level
	Teacher	Student	Pre	Post	SRI
1. How does the use of the electronic edition (eEdition) World History textbook highlighting and animation tools relate to the knowledge and comprehension achieved by students on a World History test of knowledge and comprehension?			X	X	
2. Are the effects of the eEdition World History textbook tools of highlighting and animation moderated by student Scholastic Reading Inventory (SRI) level?			X	X	X

(table continues)

Table 2 (continued)

Research Questions	Data Sources				
	Focus Group Interviews		Tests		Reading Level
	Teacher	Student	Pre	Post	SRI
3. What are students' perspectives on using the highlighting and animation eEdition World History textbook tools while reading World History content?		X			
4. What are teachers' perspectives on using the eEdition World History textbook highlight and animation tools in instruction?	X				

Quantitative Analysis

The quantitative data analysis addressed the World History knowledge and comprehension achieved by the participants who underwent four conditions: (a) Highlight, (b) Animation, (c) Highlight-and-Animation, and (d) Comparison. A pretest was used as the covariate and a posttest was used as the dependent variable to assess the knowledge and comprehension scores in World History. The analysis also includes the possible moderating effects of the participants' SRI level on the World History knowledge and comprehension scores achieved. The participants' ethnicity was also considered as a moderator, but it was excluded from the analysis due to the lack of sufficient ethnic diversity to support a worthwhile analysis. In the study, 80 of 82 participants (98%) were African Americans.

Hypotheses

The null hypotheses were as follows:

1. There is no relationship between the use of highlighting and animation tool(s) and the Pretest-Adjusted Posttest knowledge scores achieved by students.
2. There is no relationship between the use of highlighting and animation tool(s) and the Pretest-Adjusted Posttest comprehension scores achieved by students
3. There is no moderating effect of participants' SRI levels on the relative effectiveness of treatment group in respect to the Pretest-Adjusted Posttest Knowledge scores achieved.
4. There is no moderating effect of participants' SRI levels on the relative effectiveness of treatment group in respect to the Pretest-Adjusted Posttest Comprehension scores they achieved.

Results

Eighty-two participants were in the study: 21 in the Comparison, 24 in the Highlight, 18 in the Animation, and 19 in the Highlight-and-Animation group. Overall, the scores increased for all groups from Pretests to Posttests. Table 3 contains the descriptive statistics of World History Pretest means and standard deviations by Group. Table 4 displays the descriptive statistics of World History Posttest means and standard deviations by Group.

Table 3

World History Pretest Means and Standard Deviations by Group

Group	Pretest Knowledge (18 questions)			Pretest Comprehension (18 questions)		
	N	Mean	SD	N	Mean	S.D.
Comparison	21	4.86	1.59	21	4.10	1.30
Highlight	24	4.96	1.80	24	3.96	2.33
Animation	18	5.33	2.17	18	4.06	2.13
Highlight and Animation	19	6.16	1.50	19	3.95	1.84
Total	82	5.29	1.81	82	4.01	1.91

Table 4

World History Posttest Means and Standard Deviation by Group

Group	Posttest Knowledge (18 questions)			Posttest Comprehension (18 questions)		
	N	Mean	S.D.	N	Mean	S.D.
Comparison	21	10.19	3.47	21	7.48	2.04
Highlight	24	7.75	2.92	24	5.92	2.34
Animation	18	8.06	2.46	18	7.89	3.55
Highlight and Animation	19	9.26	2.35	19	6.42	1.68
Total	82	8.79	2.98	82	6.87	2.55

Analysis of the Knowledge Results

A Bonferroni correction for the alpha of .05 was used for the two dependent variables, knowledge and comprehension, to result in a per-hypothesis alpha of .025. The data indicated that the homogeneity of variance assumption was not violated using Levene's test ($p = .143$). The results also revealed that the covariate, Pretest Knowledge, did not significantly predict Posttest Knowledge ($p = .161$). The condition that students were assigned had a significant effect ($p = .024$), on their Posttest Knowledge. Table 5 is

the statistics of the Analysis of Covariance with Posttest Knowledge as the Dependent Variable.

Table 5

Analysis of Covariance with Posttest Knowledge as Dependent Variable

Source	df	Mean Square	F	p	Partial Eta Squared	Observed Power
Corrected Model	4	24.33	3.00	.02	.13	.77
Intercept	1	434.39	53.59	.00	.41	1.00
Pretest Knowledge	1	16.23	2.00	.16	.02	.28
Condition	3	27.01	3.33	.02	.11	.73

A K-Matrix contrast analysis to address possible differences between the mean Posttest Knowledge score of the Comparison group to that of the Highlight, Animation, and Highlight-and-Animation group showed that both the Highlight group ($p=.005$) and the Animation group ($p=.016$), had significantly different Posttest Knowledge mean scores than the Comparison group. The Posttest Knowledge of the Highlight-and-Animation group was not significantly different ($p=.180$), in contrast to the Posttest Knowledge mean of the Comparison group.

To interpret the differences in the groups' mean Posttest Knowledge, an analysis of the group means that were adjusted for the effect of the covariate was conducted. The results indicated that the adjusted Posttest Knowledge means of 7.836 for the Highlight group and 8.045 for the Animation group were significantly lower when contrasted to the adjusted Posttest Knowledge mean of 10.30 for the Comparison group. Although the mean Posttest Knowledge of 9.041 for the Highlight-and-Animation group was also

lower than the Posttest Knowledge mean of the Comparison group, it was not significant at the .025 level of significance.

The results of the groups' Posttest Knowledge means indicated that the Comparison group had a higher Posttest Knowledge mean, 10.19, than the Posttest Knowledge mean of 7.75 that was achieved by the Highlight group. The Comparison group's Posttest Knowledge mean was also higher than that of the Animation group, 8.06, and than that of the Highlight-and-Animation group, 9.26. The null hypothesis that there was no relationship between the use of highlighting and animation tool(s) and the Pretest-Adjust Posttest knowledge scores achieved by students was rejected. The use of the eEdition World History highlight and animation tools resulted in lower Posttest Knowledge means for the eEdition groups in contrast to the Posttest Knowledge mean of the Comparison group. The variance in the dependent variable that was due to the condition was 11%.

Analysis of the Comprehension Results

A Bonferroni adjusted alpha of .025 was utilized to address the 2 dependent variables and indicated that the homogeneity of variance assumption was violated based on Levene's test ($p = .014$). An Independent Samples Median Test was utilized to compare the Comprehension Posttest medians across groups rather than the Comprehension Posttest means across groups. The test results ($p = .006$) indicated that the median Comprehension Posttest for the groups differed significantly.

Analysis of the Effect of the SRI Moderator on the Knowledge Results

The participants' SRI levels were categorized into three levels. The SRI scores below 1000 were categorized as below-grade level, the SRI scores between 1000 and 1100 were categorized as at-grade level, while the SRI scores above 1100 were categorized as above-grade level. A Factorial Analysis of Covariance (Factorial ANCOVA) with Posttest Knowledge and Pretest Knowledge as the dependent variables, SRI and Group as the factors, and utilizing a Bonferroni adjusted alpha of .025, indicated that the assumption of homogeneity of variance was not violated using Levene's test ($p=.094$). The analysis indicated that the participants' SRI level ($p=.052$), did not significantly impact their Posttest Knowledge (see Table 6).

The data revealed no significant interaction ($p=.942$), between Group and SRI level. The null hypothesis that there were no interactive effects of SRI level and Group on Posttest Knowledge score was not rejected.

Table 6

Factorial Analysis of Covariance With Posttest Knowledge as Dependent Variable

Source	df	Mean Square	F	p	Partial Eta Squared	Observed Power
Corrected Model	12	13.31	1.63	1.02	.221	.790
Intercept	1	397.55	48.83	.000	.414	1.000
Pretest Knowledge	1	12.63	1.55	.217	.022	.233
Group	3	22.11	2.71	.051	.106	.636
SRI level	2	25.05	3.07	.052	.082	.576
Group*SRI	6	2.32	.28	.942	.024	.123

Analysis of the Effect of the SRI Moderator on the Comprehension Results

The Factorial ANCOVA with Posttest Comprehension as the dependent variable, SRI and Group as the factors, and Pretest Comprehension as the covariate and Bonferroni adjusted alpha of .025 indicated the assumption that Pretest Comprehension and Posttest Comprehension were independent of each other was significant as shown by Levene's test ($p < .001$). The assumption that the group variances on the Pretest Comprehension and the Posttest Comprehension were equal was violated. An Independent Samples Median Test indicated that the hypothesis that the medians of the SRI level are equal across the groups was not significant ($p = .566$).

Summary

The quantitative results of the Posttest Knowledge indicated significant differences between students who used the eEdition textbook tools and students who did not use any electronic tools. The level of significance favored the use of the traditional textbook rather than the eEdition textbook. Analysis of the Posttest Comprehension data showed a violation of the homogeneity of variance assumption. An Independent Samples Median test also indicated significant differences in the medians of the groups for the Knowledge results. The groups' medians were not significant for the Comprehension results. The results also revealed that the participants' SRI levels were not a significant influence on the condition to which they were assigned. The following section analyzes the results from the teacher and student focus group interviews.

Qualitative Analysis

The qualitative data were derived from Focus Group Interviews and were used to address teacher and student opinions of the World History eEdition textbook highlight

and animation tools. An open exploratory coding strategy was used to classify the interview data. The codes “ease of use” and “choice” predominated among the focus groups when describing their opinions and experiences on how the use of the highlight and animation tools contributed to achievement in World History. The ease of use code was characterized by: (a) time required to learn to use the tools, and (b) time to complete the tasks. The code of choice was categorized into: (a) choice of instructional tools, and (b) choice in monitoring and assessing student activity.

Ease of Use in Learning to Use the Tools

The Teacher and Student focus group opinions on the ease of use in learning to use the eEdition tools will be addressed in the following sections.

Teacher focus group. According to teachers, the students experienced minimal difficulty in learning to use the highlight and animation tools. A teacher explained that “as students gradually became familiar and comfortable with using the tools their actions became more confident by the second session.” “They asked less questions about how to use the tools and the students were highlighting relevant information, rather than entire pages or paragraphs as they did when we first started.”

Based upon teachers’ beliefs, the type of learner is a significant factor in the use of highlighting and animation. They explained that some students, such as English Language Learners (ELLs), need more time to complete a task. A teacher added “my students are more oriented to using pen-and-paper and need more time to adjust to the use of the tools in learning.” The teachers indicated that while some students were able to quickly grasp how to use the tools, due to factors such as their familiarity with technology and its uses, other students were less proficient with using technology. They

also pointed out that at least 2 hours are needed to teach students and to provide practice that would enable students to gain mastery with using the tools. In their opinion, initially, the teaching and practice session would subtract from the instructional time, but the time would be eventually recouped due to the speed afforded by the eEdition textbook in scrolling pages, reviewing, or verifying highlighted information and playing animations.

Student focus groups. The Highlight and the Highlight-and-Animation Interview Focus Groups indicated that they experienced negligible difficulty with learning to use the highlight tool. Learning to use the highlight tool took approximately 20 minutes, according to the Highlight and the Highlight-and-Animation Focus Group. A participant stated “it took about 10 minutes to learn to use the animation tool.” The groups had not used the eEdition textbook or the tools prior to the study.

In comparison to the Highlight and Highlight-and-Animation Focus Group responses, the Animation group did not all agree that the use of the animation tool helped in completing the task. The loading speed of the animation and pages were different for this group and affected their experiences with using the animation tools. A participant pointed out that the animation page took a long time to load after the animation was selected. The overall agreement was that the assignment required 20-30 minutes longer to complete. A student stated “because the computer locked up and I had to wait for it to load the animation, I wasted time waiting.” Once the page was accessed, the time to read the information in the eEdition textbook and complete the task was the same, based on the participants’ responses. The Highlight and the Highlight-and-Animation group did not share the difficulties discussed by the Animation group with using the tools.

Aside from the time delays due to frozen screens, the Animation Focus Group indicated a preference for using the eEdition textbook animation tool rather than using the traditional textbook. The “frozen” screens and delays with scrolling through the pages were the only difficulties the Animation Focus Group participants expressed that they experienced when using the animation tool during the study. They also would use the animation tool in the future and would recommend the use of the tool to peers.

Ease of Use to Complete Tasks

In the following sections the Teacher and Student focus group beliefs on the ease of use in using the eEdition tools to complete tasks will be addressed.

Teacher focus group. The teachers indicated that they had never used the eEdition World History textbook tools during previous instruction. They observed that when students used the eEdition World History textbook tools of highlighting and animation, the students increasingly relied on and used the tools to complete the assigned questions. According to a teacher, the tools “overshadowed students’ use of the traditional textbook. When the students used the tools they were able to verify and review information quicker than when they are using the regular textbook.” Another teacher added “the tools contributed more to students learning the World History content, because they were able to complete the assignment in its entirety and in a shorter time than when they used the traditional textbook.”

The teachers explained that the students returned to highlighted information such as vocabulary and main ideas to aid in identifying appropriate responses to the assigned task. Students, they pointed out, were able to quickly scroll through the pages they read and pinpoint highlighted information in comparison to using the traditional textbook,

where the important information was not easily discernable for verification of appropriate responses or for review.

Highlight focus group. A Highlight group participant described the use of the tools as akin to “reading with hooks” because they could immediately focus on the highlighted information as needed, and that this ability was not possible without the tools because they were unable to mark information in their books. The group noted that it took less time to maneuver through the book and to use the highlight tool than to use the traditional World History textbook to do the assigned activity. A participant expressed “the book took forever.” A participant agreed that “if I was able to use the highlight tool since the school year began, I would like history more.” The overall opinion was that the tool impacted their achievement positively because they found it easier to read the textbook when aided by the tool(s).

Animation focus group. Most of the participants in the Animation group explained that it was quicker to use the eEdition textbook than it was to use the traditional textbook. A participant expressed “completing the assignment would have taken twice as long if I was using the regular textbook.” In contrast, a group member indicated a preference for using the traditional textbook because the computer “locked-up” and he had to wait for the information to load. He added that the pictures and pop-up information provided by the animations helped in answering the questions and explained that: “Normally I would have to spend more time to read a lot of pages to understand and complete my work.” When the animations played without the time delays he was able to complete the task in less time than when he used the traditional textbook.

Highlight and animation focus group. According to the Highlight-and-Animation group, the use of the tools of highlighting and animation contributed to learning the World History information. In normal reading from the textbook, the students explained that they engaged in searching for information to complete assignments. A participant said “I don’t have to read everything over again if I need to go back to the information, because I could easily go back and find the highlights without searching through everything.” Another participant expressed “it is difficult to read back and forth from page to page in the normal textbook and I forget where to find important stuff. When I highlight the words I can go back and see what I did.” The Highlight and Highlight-and-Animation focus groups reviewed the information they highlighted, and believed that review was important for examining whether the highlighted information such as key words, definitions, or ideas related to the assignment.

Choice of Instructional Features

The results of the Teacher and Student Focus groups on the choice of instructional features will be addressed in the following sections.

Teacher focus group. The teachers believed that the use of the animation tools could help to enhance the information for student as they replayed animated features to review, verify, or locate information. Teachers pointed out that the animation tools were designed to focus on augmenting the key ideas of the text information quickly and seamlessly. The options enabled by the animation tools that the teachers believed aided in student achievement in World History included the maps that incorporated features to allow selection of keyed items to reveal pop-up text information or identifiers of locations, descriptions, or movement.

During the review stages of the study, teachers observed the students rereading highlighted information and changing previously highlighted information. In the opinion of the teachers, the option to change previously highlighted information and replay animations benefited the students academically. They explained that the ability to review information aids in academic success. When the students changed the highlighted information apparently, their actions facilitated review because they reconsidered the information in view of the task and then fine-tuned the highlighted information to coincide with accurately answering the questions.

Highlight focus group. A participant in the Highlight group stated “without the tool it is no different than reading the regular textbook” and “it is more interesting than reading the regular textbook.” The Highlight Focus Group participants indicated that the use of the highlight tool gave them the choice to mark the information they read. They could then return to the previously highlighted information to remind them of key ideas or as a reference point for further reading. I can “learn faster, remember what I read and get more done” were the choices afforded when using the highlight tool, according to a student participant.

Marking text information with highlighting did not change the information, based upon the overall responses of the highlight interview focus group, but the highlighted information influenced their recall of the information because it focused their attention on key words or ideas. A participant indicated “the words that I highlighted made it easier for me to answer the questions or go back and make sure my answers were correct.” Days after completing the assignment, a participant recalled reading about the Almoravids and the Almohads in the *Societies and Empires of Africa* topic and said “I remember

highlighting things about the groups, like the Almoravids and Almohads were Muslims and that they both took over the people around them. Their empire became very large and their Islam religion spread to other places.” She stated “I can even draw the map and the arrows to show how they moved across the map and took over the people.” Another participant mentioned recalling that Ghana’s Empire became powerful due to their gold trade because they highlighted the information during reading, and added: “I would not remember anything. It is better with the highlighting.”

The highlight interview focus group mentioned that the use of the highlight tool added to their enjoyment in reading the text because they could change the information by picking out information they chose with highlighting. A participant shared “all you see is words, and highlighting helps me to remember what I read.” Another participant explained that the 2-page view of text, as shown by the traditional textbook, is too much information and that they liked the option to focus on a small portion of the information at a time by using the highlighting tool. Another participant mentioned highlighting the cause of the decline of Mali while reading the information in the topic *Societies and Empires of Africa*, and that they were able to recall the cause of that failure (lack of leadership) because they could highlight the information.

Animation focus group. Replaying animations gave students the choice of how to review or verify information. Many students replayed the animations because the information could be reviewed or verified more quickly and more comprehensively than if they read the text. In studying the *Societies and Empires of Africa* content, a student participant revealed that they would choose to use the animation tool in the future because “it told me where the trade routes were,” and another participant voiced “it

showed me information that I did not see before that were really interesting.” The group shared specifics such as the different countries and their location and how the identifying features of key ideas became more obvious due to the augmentation provided by the animation tools, such as pop-up text boxes and flashing symbols.

“If I could not use the animation tool I would prefer to use the regular textbook” was the opinion shared by a member of the Animation Focus Group. The use of the animation tool positively impacted the experiences of the Animation group. In comparison to reading from the traditional textbook, a participant explained: “I would not remember as much as I did if I did not use the animation tool.” After playing the animation a single time, the group indicated they were provided with the information to understand the topic and “I got all the information that I needed to answer the questions on the worksheet,” stated a group member. The animation tool increased the knowledge and comprehension of what was learned because without the use of the arrows, the ability to understand and comprehend the information would be less likely, according to the students’ responses.

The participants indicated that they liked the option of using the animation tool because it enabled specific information to be viewed in isolation from redundant information. A participant explained “some of the visuals could be distracting or did not really help me to understand the trade routes, but the animations included words or arrows that helped me understand more stuff.” The participants’ elaborations indicated that the use of the eEdition animation tool enabled them to select specific information and focus on important information. The participants agreed that the animation tool was an

advantage of using the eEdition World History textbook, and that without the animation they would be unlikely to use the eEdition World History textbook.

Highlight and animation focus group. “I like to watch the movement to really understand what is going on” expressed a Highlight-and-Animation group participant. This focus group indicated they often replayed animations 2-3 times to understand concepts by watching the movements and reading the pop-up information displayed by the animation tool. “I know where Ghana, Mali, and Songhai are on the map” was an example of specific World History information recalled when a participant chose to replay animations. The Highlight-and-Animation group added that the reading became easier and they were able to become more focused because they could choose to use the highlight or animation tool. They described their overall use of the highlight and the animation tool as “fun,” “not boring and more hands-on,” “kept me awake,” and that overall that it was a different setting than in their regular World History class and the assignment was more manageable.

In the opinion of the Highlight-and-Animation focus group, the use of the highlighting and animation tools added to their enjoyment and motivation while reading the World History information because it was “more interesting” than when they read from the traditional textbook. According to a member, “the pop-up information and flashing signals made what I read more exciting” and I could choose the information I wanted to highlight.” The ability to self-select text with highlight was the highlighting feature noted as contributing to their reading enjoyment.

Choice in Monitoring and Assessing Student Work

The teachers explained that in the future they would use the tool in instruction as a way to monitor students' assignments. The highlighting actions that students undertake and do not change are saved to their password. A teacher pointed out "my students might be reading but I don't know if they are focusing on the essential information, and I can now go back and look at what they highlighted when they read." Teachers indicated that they can review the information students highlighted to determine applicability to the assigned task and then assess the need to reteach or to progress to a new topic. A teacher explained "as I walked around I could easily see what the kids were doing when they were reading the book, even when they were in the last row of the class."

The teachers mentioned the ability to quickly identify how students are using the tools as an important option in instruction. A teacher stated "normally the book is laid flat and I cannot see what they are doing quickly, but I could easily see students interacting with the information they were reading" from the eEdition textbook, due to the increased visibility afforded by a raised computer. The highlighting and animation tools available with the eEdition were cited by the teachers as the main reason for their willingness to recommend the tools to peers or students.

Summary

The initial section of the chapter analyzed the quantitative data to determine if the highlight and animation tools in an eEdition textbook influenced the knowledge and comprehension of World History that students achieved. The results indicated significant differences in the World History knowledge achieved when learners used the eEdition textbook tools, when compared with students who did not use any electronic tools. Use of

the traditional textbook was more beneficial, based on the level of significance. Although no significant difference was evidenced for the Posttest Comprehension means, the means were higher for the Comparison group than for the eEdition groups. The results also revealed that the participants' SRI level was not a significant influence on the knowledge test scores after using the highlight and animation tools.

In the final section of the chapter, teachers asserted that it was a positive experience for students to use the highlighting and animation tools, and that they would be willing to use the tools in future instruction due to the instructional options available. Access to computers was the only obstacle the teachers mentioned that would prevent them from using the tools for instructional purposes. It was affirmed during the interview that the possibility to combine the various tools in instruction, such as combining the highlighting and the animation tools, could be advantageous. However, the teachers cautioned that the task should be suited to the tools and their features before utilization in instruction. The teachers suggested incorporating tests that included highlight and animation tools for improving the use of the tools available with the eEdition World History textbook.

The Highlight Focus Group believed that highlighted information influenced their recall of the information because it focused their attention on key words or ideas. The option to highlight key words or text helped them to answer the questions and also helped in verifying their answers. In their opinion the eEdition tool could be improved if the highlight tool could be combined with the use of tools such as a glossary, to aid in comprehension during reading. The glossary tool is available with the use of the eEdition World History textbook but was not utilized during the study.

The Highlight-and-Animation Focus Group indicated they would be willing to use the tools in the future and would recommend the use of the tool to a peer. According to the Highlight-and-Animation Focus Group, the use of the tools decreased the amount of time they would normally spend on reading in World History. A discussion on the findings, recommendations for future research and instruction, and conclusions will follow in Chapter 5.

CHAPTER 5

DISCUSSION

In this chapter, the relevant findings from the quantitative and qualitative data will be discussed to assess the impact of electronic textbook tools on student achievement in World History. The final sections are the recommendations, reflections, and concluding remarks.

The quantitative results of the Posttest Knowledge revealed that the eEdition groups had significantly different mean scores than the mean score of the Comparison group. Further in-depth analysis indicated that the Highlight and the Animation group had significantly lower Posttest Knowledge means than the Comparison group. The mean Posttest Knowledge of the Highlight-and-Animation group was also lower than that of the Comparison group, but it was not significant. The use of the Highlight and Animation tools appeared to be deleterious for the achievement of World History Knowledge.

Analysis of the Posttest Knowledge results showed that the covariate, Pretest Knowledge, was not a significant predictor of Posttest Knowledge. Analysis of a scatter plot indicated wide dispersal of the Knowledge scores. This surprising finding could result from the limited time available for the participants to gain familiarity with the instructional formats and the environment. For instance, in the initial stage of the study, the eEdition groups were relocated to a computer lab and possibly lacked focus while

completing the Pretest. Analysis of a scatter plot indicated wide dispersal of the Knowledge scores.

Due to the violation of the homogeneity of variance assumption, analysis of the Posttest Comprehension data was not conducted. The participants' SRI level did not significantly moderate the effectiveness of the conditions.

According to the student focus groups interview data, 100% of the respondents indicated that they would be willing to use the highlight and animation tools in future learning tasks and that the tools positively impacted their completion of the tasks and their enjoyment in learning the information. However, the quantitative data showed that the overall Posttest Knowledge means of the eEdition groups were significantly lower than the mean achieved by the Comparison group. Prior knowledge, the context of the study, the time on task, and the tool-to-task match are factors that could influence the findings. These factors will be discussed in further detail in the following sections.

Prior Knowledge

Previous researchers (Owens & Dwyer, 2005; Sweller et al., 1998) have cited prior knowledge as a significant factor in student achievement. In the following sections the influence of students' and teachers' prior knowledge will be discussed to add clarity to the dissimilar results from the quantitative and qualitative data.

Students' prior knowledge. Reading ability can be used to gauge prior knowledge, so the participants' SRI level was used to assess their reading ability and also used as a moderator. The Pretest Knowledge and Comprehension identified the participants prior knowledge of the World History information utilized in the study.

The SRI level moderator was considered as a possible cause for the higher Posttest Knowledge and Comprehension means demonstrated by the Comparison group, because a higher number of above-grade level SRI scores in the Comparison group could explain the higher mean earned by the group on the Posttest Knowledge and Comprehension. Consequently, if a lower total of above-grade level participants were evidenced in the eEdition groups when contrasted to the participants in the Comparison group, then that could account for the dissimilarities between the qualitative and quantitative results.

An analysis indicated that of the 82 participants, 44 had SRI scores that were below-grade level, 11 had SRI scores that were at-grade level, and 27 had SRI scores that were above-grade level. The total SRIs below-grade level, at-grade level, and above-grade level were respectively 12, 3, and 6 for the Comparison group, 14, 2, and 8 for the Highlight group, 7, 4, and 7 for the Animation group, and 11, 2, and 6 for the Highlight-and-Animation group. The total number of below-grade level, at-grade level, and above-grade level participants was not equal across the groups.

Further analysis of the SRI data showed that regardless of group assignment, the above-grade level SRI participants had the highest Pretest and Posttest Knowledge and Comprehension means and SRI did not have a significant influence on the results. The knowledge and comprehension from Pretest to Posttest increased for all SRI levels, but no significant difference was evidenced in the mean Pretest Knowledge or Comprehension across SRI levels. The change in score from Pretests-to-Posttests remained similar for the SRI categories, as demonstrated by the mean increase for the

below-grade level, at-grade level, and above-grade level SRI of 64%, 69%, and 68% respectively.

Therefore, SRI level was not a significant factor for explaining the contradictory results. Research by Williams and Dwyer (2004) on the effectiveness of animation, prompting, and cuing has revealed that participants with lower prior knowledge never outperformed those with higher prior knowledge. To aid in further clarifying these findings and to address the difference in findings from the qualitative to the quantitative results, a possible solution would be to partial out the SRI level so that they were equal across groups and then re-do the analysis. Although the reading level of the textbook was rated at-grade level, it is important to note that the change in mean score for the below-grade level participants did not differ significantly when compared to the other SRI groups. The data of the SRI levels were not contrasted to each other, so a possible option to address the differences in the participants SRI proficiency level would be to compare the Posttest Knowledge and Comprehension means for the below-grade level, at-grade level, and above-grade level SRIs across the Highlight, Animation, and Highlight-and-Animation groups.

The level of English language acquisition also influences prior knowledge, but was not addressed as a moderator. Almost 20% of the student population were English Language Learners and including this group as a moderator in the analysis could add clarity to the results because Cognitive Load Theories emphasize that an overload of information can negatively impact learning for low prior knowledge individuals such as ELLs (Sweller et al., 1990; Sweller et al., 1998). In the study, the animations included attention-getting features such as flashing and pulsing arrows. These various animation

characteristics can serve to split attention, as posited by Owens and Dwyer (2005), and could be especially overwhelming for participants with low prior knowledge.

Teachers' prior knowledge. A teacher's pedagogical content knowledge (PCK) or prior knowledge of pedagogy and content can factor significantly in learning success when utilizing eEdition tools. According to Darling-Hammond and Bransford (2005), PCK is the ability of the instructor to anticipate student understanding or lack thereof and knowing how to remediate misunderstandings if they surface. Providing specific guidelines and a foundation for learning success were stipulated by Darling-Hammond and Bransford (2005).

Although the students were provided with guidelines for using the animation and the highlight tools, their use of the tools revealed a lack of foundation in understanding the purpose of the tools and the tasks, due to the wide variations in how they used the tools to complete the questions. These are important instructional considerations because if a student highlighted an entire sentence, while another highlighted only key vocabulary, entire pages of text, or did not use the highlight or animation tool, then achievement could differ. Understanding these differences can help instructors to improve their craft to meet the needs of their learners.

The teachers noted that initially, some students highlighted entire pages of text. Students also indicated that they played animations only once, while others stated that they repeatedly played the animations. When an inordinate body of text was highlighted, such as an entire page, the participants were provided with further scaffolding in the form of examples and students repeating the modeled instruction. For instance, the students were given verbal instruction to highlight key portions that contributed to answering a

question and then directed to practice the instruction. As the students' use of the tools became more accurate these scaffolds were reduced and eventually removed. During the study, the participants were not redirected to highlight any particular correct or incorrect information. In the regular classroom setting, applying appropriate scaffolds to help students increase their knowledge of the purpose of the tools toward accurate accomplishment of learning tasks would be needed.

In the study, the participants had to complete two types of tasks: (a) knowledge and (b) comprehension questions. Almost all of the knowledge questions could be answered by the information contained in a single sentence from the text, but the comprehension questions required information from various parts of the text. Therefore, further PCK of appropriate scaffolds was necessary. Such PCK would focus students on the essential components needed to complete the tasks and by reviewing questions as needed. Although the accuracy of the highlighted information was not assessed or remediated, due to the time constraints imposed on the study and to prevent simply giving students the correct answer, developing this skill would be an important pedagogical consideration in regular classroom settings.

How accurately the use of the tools is matched to the purpose of the task is also heavily influenced by the prior knowledge of the learners and the implementation of appropriate instruction. For example, almost 50% of the participants had SRI scores below their grade level and also below the SRI level of the text they read. Therefore, they could overuse or underuse the tools because they lack the foundation necessary to comprehend what they read. The teachers' PCK of how to use the eEdition tools also influences the learner's processing of the information read. Thus, when eEdition tools are

used in learning, the instruction should reflect a comprehensive understanding of the task, the tool, and the learner. Teachers need to be cognizant of differences in the learners' prior knowledge, their understanding of the task, and how they use the tools, and then apply remediation such as reviewing how, when, and why the tools are used.

All sessions of the study were overseen by two state-certified instructors of social studies and the participants were allowed to interact with neighboring peers and instructors, except during the pretest and posttest. Vygotsky (1986) alluded to the critical link between the learner's background and the social environment, but the function of language, perception, thinking, attention, and memory were not addressed in analysis of the posttest results. The Focus Group interviews did address the factors of perception, thinking, attention, and memory, but the interview questions were not utilized to tap into the actual conversations that took place between the participants to document the social interactions and whether they added to or detracted from completion of the tasks. Rather, the Focus Group questions only targeted the individual's experiences, perception, thoughts, and memory, and not what was shared with other participants.

The Teacher and Student Focus group data revealed distinct differences when compared to the quantitative data. The qualitative data indicated that none of the participants had prior knowledge of the eEdition tools but would use the eEdition tools on future learning tasks and believed the tools aided in learning the information. However, an important consideration in student success when learning with eEdition tools is the teacher's PCK and the appropriate application of strategies such as scaffolding. Blachowicz and Ogle (2001) pointed out that limited time in which to cover content requires the use of tools to focus attention and aid in comprehension. Thus, when

eEdition tools are incorporated in instruction the teacher's PCK becomes vitally important. The next section will discuss the relevance of context in interpreting the findings of the study.

Context

The participants in the Comparison group underwent the study in their regular classroom setting, whereas those in the Highlight, Animation, and Highlight-and-Animation groups did the study in a computer lab. Thus, the change in environment could help to explain the lower scores earned by the Highlight, Animation, and Highlight-and-Animation groups. The time for the eEdition groups to acclimate to their surroundings could be increased by extending the duration of the study.

Reading information from a computer screen or from a traditional textbook also influences the context and could impact the study results. For instance, the glare from a lighted computer screen could be unfamiliar to the participants and affect the degree of attentiveness and willingness to complete the assignment. The participants' hand-eye coordination was also required to scroll up and down the screen. The users of the traditional textbook did not need to become familiarized with glares from a computer screen and scrolling up and down a computer screen. A future research consideration would be to switch conditions between the participants so that each condition would be used by all the participants for the same duration but at different intervals. In the next section, the influence of time-on-task on the research results will be discussed.

Time-on-Task

The time to learn to use the tools could be extended to enable the participants to adjust to the learning tools. The Focus Groups had never utilized the eEdition textbook or

tools prior to the study but believed that if they were allowed time to use the Highlight tool since the school year began, their achievement would be positively impacted because the eEdition textbook was easier to read. Teacher Focus group participants also indicated that at least 2 hours is required for learning to use the tools.

Unfortunately, some participants in the Animation, and Highlight-and-Animation Focus Groups indicated that the animations sometimes took a long time to load or that the screen froze and they had to wait for it to unfreeze. As more tools were engaged, the incidents of longer load time and frozen screens increased. These factors reduced the time-on-task for the participants in the Animation, and Highlight-and-Animation group to varying degrees, and could have influenced the quantitative results. For example, an analysis of the aggregated Posttest Knowledge and Comprehension means indicated that the range in the scores for the Comparison group was less than the range in scores for the other groups. The aggregated Posttest Knowledge and Comprehension means for participants in the Comparison group ranged from 17.17 to 17.81, 10.83 to 15.90 for the Highlight group, 13.10 to 17.80 for the Animation, and 14.70 to 17.50 for the Highlight-and-Animation group. The larger range in scores for the eEdition groups could evidence a lack of focus and the possibility that the eEdition groups were inappropriately oriented to the learning tools or learning environment. Time to learn to use the tools as well as the limited capabilities of the Internet Service Provider could have deleteriously affected the study because of the issues related to the speed in loading selected pages and learning to maneuver through pages. The difference between the results of the qualitative and quantitative results could also be due to a lack of match between the tool and task. The next sections will discuss this factor in further detail.

Match Between Tool(s) and Task

According to the student Focus Groups, the eEdition tools helped them in managing the information they learned by chunking it to suit the specific learning task and how they learned. The student focus group member pointed out “all you see is words, and highlighting helps me to remember what I read.” Although the highlighting tool was user-controlled and the text that was highlighted differed among the users, all the posttest questions could be answered by the information provided. However, an analysis to verify the accuracy of the information highlighted toward answering applicable questions was not conducted.

How the highlight tool is used in terms of what information is highlighted is an important consideration. Chi et al. (2007) reported that when text is highlighted, significantly more attention is directed to the highlighted information. An appropriate match between what is highlighted and the task can result in learning gains as much as 30% higher than are demonstrated when the highlight is inaccurate or absent (So & Chan, 2009). Thus, the use of highlighting and the accuracy of the highlighted information can be critically important during instruction (Hurt, 1987).

Cues such as highlighted information and animation can be advantageous (Reinking et al., 1988) so the animations were assessed to determine their match to the task. However, unlike the user-controlled highlighting tool, users saw identical information each time they used the animation tool, so an analysis of the match between the content of each animation and the posttest questions was conducted. All the animations utilized in the study were analyzed to determine their content. The content

was then assessed to determine if it could be used to answer all or part(s) of the knowledge and comprehension questions.

Of the 36 items on the Posttest Knowledge and Comprehension, only 9 questions were ideally suited to be answered by the animations. The animations revealed information that was not contained in the text content but the extra information added to correctly answering the 9 questions. Therefore, the mismatch between the tool(s) and task could be decreased by reviewing and changing applicable questions to appropriately address the tool(s).

Effective instruction often includes visual examples to augment oral or written information for populations such as ELLs. The utilization of visuals in instruction is also supported by research that has indicated that processing of information is modality-specific (Clark & Paivio, 1991; Gyselinck et al., 2008). When written text is supported by visual information a dual cognitive pattern is possible, and when recalled, the information is more in depth than is the information recalled if only a single communication mode was learned.

In the study, the highlight eEdition tools accessed the written text and the animation eEdition tool accessed the visual information. Under ideal circumstances, the visual and written information accessed by the eEdition tools should carry equal value toward accurately completing the task. However, only 6 visuals incorporated the animation tools, and only 9 of 36 posttest questions could be accurately answered by the information contained in the animations. Meanwhile, the highlight tool could be used to highlight text that contributed to answering all the questions. Consequently, the animation tools would only advantage the Animation groups in answering 25% of the

questions. An analysis of the groups' results for the nine questions that could be answered by the animations revealed that the average aggregated (Knowledge and Comprehension) posttest mean was between 4 and 5. Therefore, the use of the animation tool did not appear to benefit the groups that used the animation tool.

A possible reason for the results is that the information contained in the animation(s) imposed an inordinate amount of germane cognitive load, or effort to process the information so it could be integrated with prior schema. For instance, some of the animations contained pop-up text boxes and additional visual information that required integration with the regular text. Some of the animations also included signaling sounds or other extraneous cognitive load in the animation presentation modality that could also compromise learning from the animations. Some members of the student focus group found that the animation content was beneficial in learning the information. Others indicated that some of the animations froze and they had to wait for them to unfreeze. However, the impact of this experience on their learning was not assessed by the data revealed by further probes.

Improving the match between the tool and the task is an option that could be considered in assessing the discordance between the quantitative and qualitative results. For example, animations have numerous characteristics and should be carefully investigated to ensure they match the learning task. Wouters et al. (2008) and Mayer and Moreno (2002) explained that the features of each animation should be appropriately selected for each instructional task in order to determine the effectiveness of animation tools.

The discord between the qualitative and quantitative results for the Highlight, Animation, and Highlight-and-Animation groups could also be attributed to the lack of match between how the participants learned the task and how they were assessed. The Comparison group learned using the familiar traditional World History textbook and then took the paper-and-pencil Posttest Knowledge and Comprehension. In contrast, the Highlight, Animation, and Highlight-and-Animation groups learned with the unfamiliar interactive eEdition textbook tools which were not reflected in the static paper-and-pencil Posttest Knowledge and Comprehension that they took. A Posttest Knowledge and Comprehension that utilized the mode in which the participants learned the information could possibly yield different findings.

Recommendations

The evidence indicates that more research is needed to gain further understanding of the impact of eEdition tools on student achievement and the dissimilar results demonstrated by the quantitative and qualitative data. The findings from this research highlight the importance of factors such as prior knowledge, time-on-task, tool-to-task match, and learning context on student achievement when learning with eEdition tools.

Recommendations for instruction. Instructional technologies such as highlighting and animation tools have continued to increase, yet insufficient data are available to assess their value. The focus groups indicated the benefits of using the tools but added that more time is needed to learn to use the tools. Therefore, it is recommended that instructors provide students with more access to and use of eEdition tools during instruction. Teachers and students in the focus groups had not utilized the eEdition textbook prior to the study, although it was freely available to the district for over 5 years.

Wade and Trathen (1989) indicated that when participants are actively engaged in selecting and using the highlight tool, their processing and retention of the material surpassed that of the participants who did not utilize the highlighting tool. Limited instruction that is only supported by “traditional and middling textbooks” (Bruner, 1960) disconnects learners and could compromise attainment of deeper and wider knowledge (Wolf, 1992).

Student focus group participants also discussed the benefit of using the tools to modify the information to suit individual learning needs. The ability to view selected portions of text rather than entire pages, highlight words, sentences, or entire pages were some of the capabilities that were mentioned by the participants as adding to their learning experience. According to Mousavi et al. (1995), germane cognitive load, or the effort required to process and integrate the stimuli to gain automaticity, can be compromised due to inappropriate instructional design. Therefore, if learners can adjust information to their learning needs, the germane cognitive load can be increased. It is recommended that consistent instruction and practice on using the tools be utilized to help students develop knowledge of the various tools that are available and an understanding of how to appropriately apply these tools while learning.

The research evidenced that all teachers and students would be willing to use the tools in the future due to the increased ability to review information quicker than when using the traditional textbook. The teachers believed that the information highlighted by students is invaluable to instruction because the recorded data could be used to design instruction or to remediate. Thus, it is recommended that instructors utilize the tools during instruction in areas not limited to review and assessment. For example, the

highlighted information, if undeleted, is a record of individual student action during learning because it is saved to their password. Therefore, previously highlighted information can be used by the student for review or by the teacher to assess student progress or for remediation. Instructors could use the highlight features to identify main ideas or vocabulary in a body of text as information is reviewed. Additionally, the animations could be used to elucidate information that would require more time than if it were relayed through written or verbal communication only.

According to Byrnes (2001), the More Knowledge Other (MKO) such as teachers and eEdition tools (Darling-Hammond & Bransford, 2005) could help learners to bridge the Zone of Proximal Development (ZPD), or the gap between the learner's current and potential level of learning. The teachers had never used the tools prior to the study, but mentioned that they would use the tools in future instruction. However, if teachers lack the essential knowledge or PCK to effectively incorporate the tools then learning will be compromised. Teacher and student knowledge of how, when, and why eEdition tools are used are critical components to consider when incorporating eEdition tools in the learning process. In order for students to acquire their highest learning potential, the teachers should understand how to effectively use the tools, when use of the tools is appropriate, and why the tools should be incorporated so they will be able to impart this knowledge to students. Thus, it is recommended that teacher training on effective use of the eEdition tools be offered.

To encourage instructors to use eEdition tools successfully it is recommended that teachers be trained on strategies to address intrinsic and extraneous cognitive load. Such training would include strategies for separating the components of a task, providing

instruction in manageable chunks, and reintegrating components of a lesson in order to moderate intrinsic cognitive load when learning with eEdition tools. To control the amount of extraneous cognitive load that is imposed on learners, instructional development would include topics to address English Language Learners (ELL), such as providing ELLs with written, oral, and especially visual examples whenever possible.

The analysis of the quantitative evidence did not support training teachers on using the tools to effect student academic achievement in World History. However, teacher professional development on using the eEdition tools is recommended due to the lack of teachers' prior use of the tools. Teacher training is also suggested to increase understanding of the effectiveness of the tools in relation to instructional tasks and student achievement. The high degree of enthusiasm the participants demonstrated for using the tools also provides rationale for training teachers to use eEdition tools.

Suggestions for publishers of instructional materials are that future eEdition textbooks include demonstrations on using the tools in other languages such as Spanish and French Creole, different reading challenge levels, and pronunciation for hard-to-pronounce vocabulary. The inclusions of demonstrations would enable users to learn on their own and at their own pace. Meanwhile, language translations would help to address a need demonstrated in multilingual populations. The different reading challenge levels of eEdition textbook would target students of various reading proficiency. These recommendations would add to the accessibility and eventual use of the eEdition tools by encompassing a wider and more diverse cross section of learners and instructors.

Instructional publishing entities are advised to carefully analyze the tools they utilized in eEdition textbooks to ensure relevancy to the goal or objective indicated for

each learning task. Tools that incorporate extraneous features should be modified to increase their effectiveness. The instructional design features are important considerations in instruction (Pollock et al., 2002; Sweller et al., 1998; Van Gog & Paas, (2008). De Konig et al. (2010) have found that when multiple modalities of presentation overload the brain, learning can be negatively compromised. The following section is an overview of the recommendations for research.

Recommendations for research. To address the gaps in current research and provide further ideas on eEdition tools, four topics will be discussed. The recommendations for research are focused on peripheral learning, computer access, study duration, and the match between tool and task.

The instructional approach to the use of eEdition tools could include peripheral learning that is not assessed. For instance, students could learn important knowledge that was not represented on the assessment and the assessed content could be less important for them to learn. Therefore, future research could document students' and teachers' discussions of the content while using the eEdition tools to determine if there are differences in the eventual knowledge of students.

Future research should assess the participants' computer access and their use of eEdition tools as possible factors when determining the effect of highlighting and animation electronic tools on achievement. The Teacher Focus group also indicated that the degree of familiarity with the available technologies varied widely among their student population. Therefore, researchers should identify the degree of consistent and regular computer access as well as the use of eEdition tools among study participants.

This could offset possible differences in findings that could be attributable to unfamiliarity with using eEdition tools.

Researchers of future studies could also consider adding time to study conditions, to offset unanticipated delays, the learning curve that is associated with unfamiliar learning conditions, and changes to the learning environment. The research demonstrated that all teachers and students believed sufficient time is needed for orientation on using the eEdition tools. Studying student achievement scores incrementally could also identify students' progress over time when using eEdition tools, and could help to identify the amount of time required to develop routine use of the eEdition tools.

It is recommended that future researchers assess each tool to determine how capably it addresses learning task(s) and performs as intended. For example, some animation tools can detract from the learning task by adding cognitive overloading demands (Hurt, 1987; Sweller et al., 1990). Mayer and Moreno (2002) and Mayer (2005) believed that flaws in animations could lead to inconsistent research results. In instances, some animations include audio features such as attention-getting sounds that bear little similarity to the intended purpose of the animation. Each tool has to be carefully analyzed to gauge how it can be used and how it applies to the task, and ideally the tool(s) selected should directly access the information to be learned. Appropriately matching tools to the tasks is advised for further research. The tools to be used should be carefully scrutinized to ensure that the information they can provide, when appropriately used, is reflected in the assessment(s) to be assigned. The following section discusses a few reflections on the study.

Reflections

In over 10 years of teaching I have observed that students often relied on aids such as post-it notes to mark sections of their reading. After using and learning more about the eEdition tools in the World History textbook, it was anticipated that the use of tools would lead to higher achievement gains. I also believed that the students would enjoy using the tools and find them to be effective learning aids. As predicted, most of the students did enjoy using the tools and believed they were effective aids during learning. Unfortunately, the students who used the eEdition tools were outperformed on the posttest by those students who did not use any of the eEdition tools.

After observing students' use of post-its and other reading aids in traditional settings, it was surprising that their use of the eEdition tools did not lead to the higher achievement gains that were expected. Therefore, the tools or their effectiveness were questionable, and these issues were addressed in previous sections by discussing factors such as the context of the study and match between instruction and assessment. It was also believed that the student who used the eEdition tools would have higher scores because Vygotsky's Social Constructivist theory lends credence to the idea that adding support could help a learner to achieve a higher level on the ZPD. It was anticipated that if students were provided with tools to support their learning, then the proficiency level realized would be on the upper level of the ZPD, but this was not evidenced. Therefore, in the following sections I will reflect on the research in view of Vygotsky's (ZPD) theory.

According to Vgotsky (1986), factors such as language, perception, thinking, and attention heavily influence cognition. For example, the study site included 20% of ELLs

and the presence of this ratio among the actual study would mean that some participants lacked the English language proficiency to actually demonstrate proficiency on the required tasks.

Although the participants' perception of their experiences and thought processes during the study was addressed, this formal assessment occurred after the study rather than throughout the study. In retrospect, the use of observation and related transcripts as well as questioning of the participants throughout the process would add more time-sensitive data toward understanding their perceptions and thinking process as they occurred. For instance, Vygotsky (1986) mentioned the inextricable link between each learning situation and intended or unintended forces. The unanticipated factors such as bathroom breaks, announcements, and extraneous conversations are largely uncontrollable. However, ongoing observations and recording of these factors could help to determine how they affected learners' perception, thinking, and attention. The data would also help to fine-tune information such as how and why the tools were used and how using the tools added to or detracted from learning. According to Vygotsky (1986), these factors are very important during cognition and consequently, the level of competency achieved on the ZPD. Implementing ongoing assessments of the participants' experiences could also help to identify those who most benefited from using the tools and the condition(s) that were beneficial.

For example, it was initially reasoned that SRI level would moderate the effect of using the eEdition tools. However, the lack of a moderating influence by SRI level or higher achievement among the participants with higher SRI level could result from the "ceiling effect." It was possible that the students with above-grade level SRI would earn

lower gain in means as demonstrated by contrasting the Knowledge and Comprehension Pretest to the Posttest. The Pretest Knowledge and Comprehension means of the SRI levels indicated that the means for the at-grade level, below-grade level, and above grade level were almost identical. The posttest means for the SRI groups were also similar to each other. The comparison of the SRI levels showed that the gain from the pretest to posttest was an average of 67% for all the groups. It was thus determined that the SRI groups made similar gains and the data also showed that SRI did not significantly impact the results.

My experiences during the study have led to further considerations and issues such as: (a) the conditions that are beneficial to the use eEdition tools, (b) which individuals benefit from the use of eEdition tools, and (c) effectively moderating for unintended factors in social learning situations that involve eEdition tools.

Conclusion

The academic achievement demonstrated by assessments of education show that some students require instruction that is fine-tuned to address their lack of prior knowledge. The eEdition tools were assessed to determine their impact on achievement. The results indicated that the eEdition tools were disadvantageous to achievement. The research findings also accentuated the need for the instructor to demonstrate an in-depth understanding of the relationship between the task, tool, and learner.

Assessing factors such as the learner's familiarity with the tool and their proficiency with the basic skills that are needed to accomplish the task would involve utilization of diagnostic, formative, and summative assessments. Most importantly, the instructor needs the PCK that is necessary to integrate the task and the tool for the

optimum bridging of the gap between the learner's prior knowledge and their optimum learning potential. For instance, to increase the learning potential, the objectives of the task should be clearly understood by the instructor and the learner. Thus, the instructor and student should be able to clearly demonstrate accomplishment of the task. If the task is understood, use of an appropriate tool could aid in deeper understanding of the task. Likewise, an inappropriate tool such as one that imposes undue cognitive load or is ill-matched to the task could derail learning.

These are important considerations due to the number of school districts that are beginning to administer high-stakes assessments that utilize electronic tools such as highlighting. This is especially alarming because many students and teachers had never used the tools in instruction but could be expected to use them to complete a current or future assessment. As the prevalence of technology increases more eEdition tools will be available, but additional research is needed to guide teachers, policy-makers, and educational stakeholders.

To harness the potential value of electronic tools, teachers have to be provided with the opportunities to develop their PCK in the use of electronic tools. Classrooms need to be equipped with the appropriate technological hardware and software that make the use of electronic tools more accessible. Consequently, teachers will have the skills and related resources to provide students with the instruction that will enable them to effectively and efficiently utilize electronic tools during learning.

APPENDIX A
CHILD ASSENT FORM

APPENDIX B
PARENTAL CONSENT FORM

Parental Consent Form

1) **Title of Research Study:** Exploring the impact of electronic textbook tools on student achievement in world history.

2) **Investigator:** Harry McLaughlin Ph.D./ Cathy Bonner (doctoral student)

3) **Purpose:** The purpose of this research is to investigate how student achievement in world history is impacted by their use of the highlight and animation tools in an electronic (eEdition) world history textbook.

4) **Procedures:** Participation in this study will require your child to take a pretest and he or she could receive an 80- minutes training session on using the electronic world history textbook and the highlight and animation tool(s) in the textbook. Your child will read the history content over three (3) sessions and take a posttest after. The pretest and the posttest will be on the world history content and your child will receive a score on each test. Your child could be selected to participate in an interview with the researcher and other students.

Alternative Procedures: If you do not want your child to participate, then she/he will be allowed to work in the class as they normally would and no data will be collected from your child.

5) **Risks:** The risks involved with participation in this study are no more than one would experience in regular daily activities.

6) **Benefits:** Your child may gain a greater knowledge of social studies facts and the satisfactions of knowing that they have contributed to a better understanding of world history knowledge in secondary students in South Florida.

7) **Data Collection & Storage:** All information collected about your child will be kept confidential and secure and only the people working with the study will see the data, unless required by law. The data will be kept in a locked cabinet until the data has been processed, in approximately six months, and then destroyed. The researcher will use a pseudo name when identifying all participants to protect their privacy and confidentiality.

8) **Contact Information:**

For questions or problems regarding your child’s rights as a research subject, you can contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigator(s), Dr. Harry McLaughlin at (561) 297-3965 or Cathy Bonner at (561) 755-0169.

9) **Consent Statement:**

I have read, or had read to me, the information describing this study. All of my questions have been answered to my satisfaction. I allow my child to take part in this study. My child can stop participating at any time without giving any reason and without penalty. I can ask to have the information related to my child returned to me, removed from the research records, or destroyed. I have received a copy of this consent form.

I agree _____ I do not agree _____ for my child to be audio-taped.

Signature of Subject: _____ Date: _____

Signature of Investigator: _____ Date: _____

APPENDIX C
TEACHER CONSENT FORM

Teacher Consent Form

1) **Title of Research Study:** Exploring the impact of electronic textbook tools on student achievement in world history.

2) **Investigator:** Harry McLaughlin Ph.D./ Cathy Bonner (doctoral student)

3) **Purpose:** The purpose of this research is to investigate how student achievement in world history is impacted by their use of the highlight and animation tools in an electronic (eEdition) world history textbook.

4) **Procedures:** Participation in this study will require you to 1) provide assistance to students as they learn to use the highlight and animation tools and complete guided reading questions. You could be selected to participate in a one (1) hour focus group interview to be facilitated by the researcher.

5) **Risks:** The risks involved with participation in this study are no more than one would experience in regular daily activities. All effort will be expended to keep all data collected from field notes and the focus group interview secure and confidential.

6) **Benefits:** You could also gain further understanding of how students learn world history and satisfaction that you have contributed to increased understanding of world history knowledge in high school students.

7) **Data Collection & Storage:** All of the results will be kept confidential and secure and only the people working with the study will see your data, unless required by law. The data will be kept in a locked cabinet until the data has been processed, in approximately six months, and then destroyed. The researcher will use a pseudo name when identifying all participants to protect their privacy and confidentiality.

8) **Contact Information:**

For questions or problems regarding your rights as a research subject, you can contact the Florida Atlantic University Division of Research at (561) 297-0777. For other questions about the study, you should call the principal investigator(s), Dr. Harry McLaughlin at (561)297-3965 or Cathy Bonner at (561)755-0169.

9) **Consent Statement:**

I have read, or had read to me, the information describing this study. All of my questions have been answered to my satisfaction. I have read or had read to me the preceding information describing this study. I am 18 years of age or older and freely consent to participate. I understand that I am free to withdraw from the study at any time without penalty. I have received a copy of this consent form.

I agree _____ I do not agree _____ to be audio-taped.

Signature of Subject: _____ Date: _____

Signature of Investigator: _____ Date: _____

APPENDIX D

WORLD HISTORY: SOCIETIES AND EMPIRES OF AFRICA PRETEST

World History: Societies and Empires of Africa Pretest

Section (1) North and Central African Societies

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

1. What type of society is the Efe?
 - A. a Muslim theocracy
 - B. a stateless, patrilineal society
 - C. a stateless, matrilineal society
 - D. a hunter-gatherer, forest society

2. What is emphasized by the age-set system?
 - A. the equality of boys and girls in society
 - B. the duties and roles associated with varying ages
 - C. the loyalty that people from the different age groups owe to each other
 - D. the freedom enjoyed by those who have not reached adulthood

3. Where is the region known as the Maghrib located?

A. along the Nile River	C. along the Atlantic Ocean
B. along the Persian Gulf	D. along the Mediterranean Sea

4. In general, where were the Muslim states of Africa established?
- A. North Africa
 - B. East Africa
 - C. South Africa
 - D. West Africa
5. The Almohads and the Almoravids were alike in many ways. Which of the following is true **only** of the Almohads?
- A. They unified the Maghrib.
 - B. They were Berber peoples.
 - C. They were Muslim reformers.
 - D. They made Marrakech their capital.
6. Which of the following was the chief means of governing in African stateless societies?
- A. animism
 - B. Islamic law
 - C. lineage groups
 - D. age-set systems
7. The original Almohads and Almoravids were both a part of which group?
- A. Arab peoples
 - B. Swahili peoples
 - C. Muslim reformers
 - E. Bantu-speaking peoples

8. What does it mean if an African society is matrilineal?
- A. In a matrilineal society, children trace their ancestors through the mothers.
 - B. In a matrilineal society, females inherit the wealth of the family.
 - C. In a matrilineal society, women have all the authority.
 - D. In a matrilineal society, women inherit land through their mothers.
9. Between 800 and 1500, which of the following was found in the Maghrib?
- A. Muslim state
 - B. hunting-gathering society
 - C. stateless, patrilineal society
 - E. stateless, matrilineal society
10. In the stateless societies of Africa, how were conflicts most commonly settled?
- A. through discussion and negotiation
 - B. by formal judicial procedures
 - C. through armed or unarmed combat
 - D. by the rulings of the group's leader

World History: Societies and Empires of Africa Pretest

Section (2) West African Civilizations

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

11. Which of the following **does not** describe the West African empire of Ghana?

- A. It was influenced by Islam.
- B. It grew rich by taxing the gold-salt trade.
- C. It was overrun by the Muslim Almoravids.
- D. It was the largest empire ever to exist in West Africa.

12. Which of the following **does not** describe the West African empire of Mali?

- A. It was an empire in the Sahara.
- B. It was ruled by Sundiata and Mansa Musa.
- C. It was visited by the traveler and historian, Ibn Battuta.
- D. It grew rich by participating in the gold-salt trade.

13. Which of the following **does not** describe the West African empire of Songhai?
- A. It controlled important trade routes.
 - B. It was an empire built through military conquest.
 - C. It was ruled by Sunni Ali and Askia Muhammad.
 - D. It was known for developing advanced weaponry.
14. Which of the following **does not** match the Hausa people of West Africa?
- A. They formed a savanna culture.
 - B. They were located on important trade routes.
 - C. They dominated the West African gold trade.
 - D. They developed powerful, independent city-states.
15. Which of the following **does not** describe the Yoruba people of West Africa?
- A. They were a forest civilization.
 - B. They spoke a common language.
 - C. They built the Ife and Oyo kingdoms.
 - E. They lacked a centralized form of government.
16. Which of the following **does not** describe the Benin people of West Africa?
- A. encouraged artistic efforts.
 - B. traded with the Portuguese.
 - C. was a savanna civilization
 - D. was organized as a kingdom

17. How did the rulers of Ghana grow rich?
- A. by taxing the goods traders carried through their territory
 - B. by conquering neighboring kingdoms and taking their gold
 - C. by building new trade routes to Asia
 - E. by converting the country to Islam and appointing Muslims as advisers
18. Who was Mali's first great leader?
- A. Mansu Musa
 - B. Ibn Battuta
 - C. Sunni Ali
 - D. Sundiata
19. What people broke away from Mali's empire and gained control of the all-important trade routes?
- A. the Hausa
 - B. the Yoruba
 - C. the Songhai
 - D. the Almohads
20. Why was an empire never built by the Hausa city-state?
- A. People quickly left the area in search of a new source of salt.
 - B. The Portuguese traders took over the area and enslaved the people.
 - C. There was frequent fighting among the city-states.
 - D. The African city-states could not agree on which religion-Islam or traditional African beliefs-to practice.

21. What is one way Sundiata helped the Mali Empire grow powerful and wealthy?
- A. He continued to conquer the neighboring empires, adding to Mali's power.
 - B. He kept a 100,000- man army to protect the kingdom from attack.
 - C. He made Timbuktu the most important city in the empire.
 - D. He promoted agriculture and reestablished the gold-salt trade.
22. How did Islam spread throughout Africa?
- A. It spread by conquest and through trade.
 - B. Muslim teachers traveled throughout Africa to introduce the faith.
 - C. Ibn Battuta traveled through 27 countries to teach the Qur'an.
 - E. Universities were established to teach the religion.
23. How did the empires in the Sahel grow strong?
- A. by converting to Islam and building mosques
 - B. by conquering neighboring nations and increasing their empires
 - C. by controlling and taxing trade
 - D. by building walls around their empires to protect against attack

World History: Societies and Empires of Africa Pretest

Section (3) Eastern City-States and Southern Empires

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

24. The Swahili language is a mixture of Bantu languages and _____ .

A. Arabic

C. Persian

B. Indian

D. Portuguese

25. Most of the raw materials that exchanged hands in the East African trade came from _____ .

A. India

C. Africa

B. China

D. Portugal

26. The city-state of Kilwa became an important trading center mainly because of its location in relation to _____ .

A. India and southern Africa

B. eastern and western Africa

C. northern and southern Africa

D. the Indian Ocean and the Mediterranean Sea

27. The event that had the greatest effect on the growth of Islam in East Africa was_____ .
- A. the arrival of the Portuguese
 - B. the increase of trade and commerce
 - C. the enslavement of Africans
 - D. the chaos and disruption of wars and conquest
28. What do archaeologists believe was main intention of the Great Enclosure of Great Zimbabwe.
- A. to defend the city
 - B. to convince Africans to convert to Islam
 - C. to hold enslaved persons awaiting shipment to foreign markets
 - D. to impress visitors with the power of Great Zimbabwe and its rulers
29. The name Mutapa came from a phrase meaning_____ .
- A. gold
 - B. salt mine
 - C. conqueror
 - D. slave holder
30. What did Africans mainly provide in the trade between East Africa and Asia?
- A. art works
 - B. manufactured goods
 - E. grains and produce
 - F. raw materials

31. How long did Portugal keep their ports and cities on Africa's East Coast?

- A. 5 centuries
- B. 10 centuries
- C. 1 century
- D. 2 centuries

32. What did Portugal's initial interest in African mostly seem to concern?

- A. Politics
- B. Religion
- C. Agriculture
- D. Trade

33. Which of the following places did **not play** an important role in the African trade between 800 and 1500?

- A. India
- B. China
- C. Persia
- D. Russia

34. What city controlled trade routes and was the economic, political, and religious center of an empire?

- A. Kilwa
- B. Great Zimbabwe
- C. Sofala
- D. Mombasa

35. Why did Kilwa seize Sofala?

- A. to stop Indian traders from sailing there
- B. to control the overseas trade of gold from southern Africa
- C. to punish it for not practicing Islam correctly
- D. to control the trade routes that led to central Africa

36. Which of the following best describes the Portuguese attitude toward the Mutapa?

- | | |
|---------------|-------------|
| A. Admiring | C. Fearful |
| B. Meddlesome | D. Friendly |

APPENDIX E

WORLD HISTORY: SOCIETIES AND EMPIRES OF AFRICA GUIDED READING

World History: Societies and Empires of Africa Guided Reading

Section (1) North and Central African Societies

Directions: After reading about North and Central African Societies answer each of the following questions in the space provided below each question.

1. List a hunter-gatherer society in Africa and describe two characteristics of the society.
2. Define and give two (2) characteristics of the age-set system?
3. What is the Maghrib and describe the significance of the Maghrib?
4. Describe the development of the Almohads and the Almoravids.

5. Use the graphic organizer below to list three (3) ways in which the Almoravids and the Almohads were alike and three (3) ways in which they were different.

How were the Almohads different from the Almoravids?	How were the Almoravids and the Almohads alike?	How were the Almoravids different from the Almohads?
1.		
2.		
3.		

6. Based on the map *Selected African Societies, 800-1500* on page 411 in the textbook, in what region(s) of Africa were the Almoravids and the Almohads located?

7. After reading about the Almohads and the Almoravids, which group do you think had the most influence on African society? List and describe three (3) ways in which the group, you chose, had more influence than the other.

8. What is the basis of governing in a stateless society and why would they use that means to govern their society?

9. What is the main difference between a patrilineal and a matrilineal society?

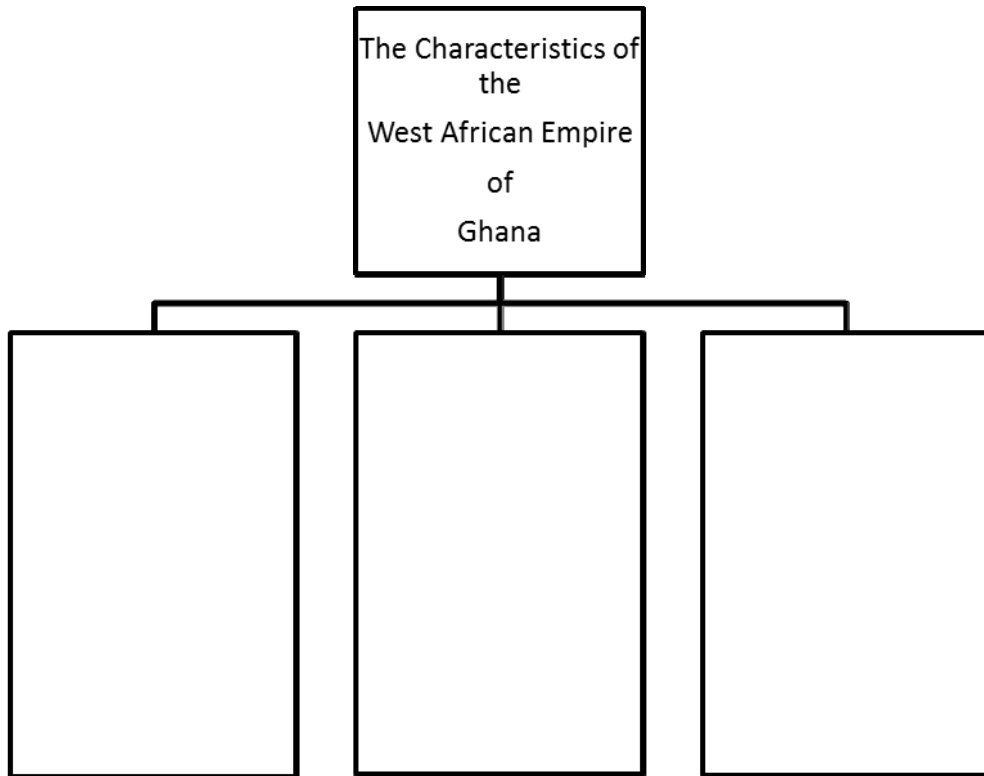
10. What was one of the biggest challenges that the Igbos encountered with 19th-Century European colonizers? Why was it the biggest challenge for the Igbos?

Societies and Empires of Africa Guided Reading Section 2 of 3

Section (2) West African Civilizations Guided Reading

Directions: Answer each of the following questions in the space provided below each question.

1. Fill-in the blank squares, of the graphic organizer below, with at least three significant characteristics that describe the West African empire of Ghana.



2. What were three (3) factors that led to the rise of Songhai and what caused their downfall?

3. What do you think contributed most to the wealth of Ghana? Use at least two (2) details to support your answer.

4. The table below lists groups in Africa. In column below each group, list three (3) significant characteristics of each group.

	Hausa	Yoruba	Benin
1.			
2.			
3.			

5. After reading about the leaders of Mali which leader did you think provided the best leadership to the people of Mali? Use at least two (2) specific details to support your choice.

6. What was the relationship between the people of Mali and Songhai?

7. Describe the relationship among the Hausa city-states?

8. Sundiata took many actions to help the Mali Empire grow powerful and wealthy, which of his actions do you think most contributed to increasing the wealth and power of Mali? Use two specific details to support your answer.

9. Use at least two (2) specific details to explain how conquest and trade is related to the Islamic religion?

10. Read and review the three (3) maps on page 414 *West African Empires 1000-1500* and identify the location of the Sahel and then explain how empires of the Sahel became powerful and strong because of their location?

Societies and Empires of Africa Guided Reading Section 3 of 3

Section (3) Eastern City-States and Southern Empires Guided Reading

Directions: Answer each of the following questions in the space provided below each question.

1. What is Swahili? Use at least two (2) details to describe its characteristics.
2. How does raw material differ from manufactured goods? Read and use the map on page 423 to identify the regions and the raw materials that each region produced and explain what happened to the raw materials that the regions produced?
3. How did the location of the city-state of Kilwa result in their success as an important trading center?
4. How did Muslim traders contribute to the growth of the Islamic religion in East Africa?
5. Why do archaeologists believe Great Zimbabwe built the Great Enclosure?
6. Describe the origin of the name “Mutapa.”

7. Why did the Portuguese come to Africa and how did the Portuguese reason for coming to Africa changed after they arrived?

8. What countries traded with Africa during 800 to 1500?

9. What was the significance of Great Zimbabwe?

10. How did Kilwa become the wealthiest and most powerful city-state?

11. Describe the relationship between the Portuguese and the Mutapa?

APPENDIX F

WORLD HISTORY: SOCIETIES AND EMPIRES OF AFRICA POSTTEST

World History: Societies and Empires of Africa Posttest

Section (1) North and Central African Societies

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

1. What type of society is the Efe?
 - E. a Muslim theocracy
 - F. a stateless, patrilineal society
 - G. a stateless, matrilineal society
 - H. a hunter-gatherer, forest society

2. What is emphasized by the age-set system?
 - E. the equality of boys and girls in society
 - F. the duties and roles associated with varying ages
 - G. the loyalty that people from the different age groups owe to each other
 - H. the freedom enjoyed by those who have not reached adulthood

3. Where is the region known as the Maghrib located?

E. along the Nile River	G. along the Atlantic Ocean
F. along the Persian Gulf	H. along the Mediterranean Sea

8. What does it mean if an African society is matrilineal?
- F. In a matrilineal society, children trace their ancestors through the mothers.
 - G. In a matrilineal society, females inherit the wealth of the family.
 - H. In a matrilineal society, women have all the authority.
 - I. In a matrilineal society, women inherit land through their mothers.
9. Between 800 and 1500, which of the following was found in the Maghrib?
- D. Muslim state
 - F. stateless, patrilineal society
 - E. hunting-gathering society
 - J. stateless, matrilineal society
10. In the stateless societies of Africa, how were conflicts most commonly settled?
- E. through discussion and negotiation
 - F. by formal judicial procedures
 - G. through armed or unarmed combat
 - H. by the rulings of the group's leader

World History: Societies and Empires of Africa Posttest

Section (2) West African Civilizations

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

11. Which of the following **does not** describe the West African empire of Ghana?

- E. It was influenced by Islam.
- F. It grew rich by taxing the gold-salt trade.
- G. It was overrun by the Muslim Almoravids.
- H. It was the largest empire ever to exist in West Africa.

12. Which of the following **does not** describe the West African empire of Mali?

- E. It was an empire in the Sahara.
- F. It was ruled by Sundiata and Mansa Musa.
- G. It was visited by the traveler and historian, Ibn Battuta.
- H. It grew rich by participating in the gold-salt trade.

13. Which of the following **does not** describe the West African empire of Songhai?
- E. It controlled important trade routes.
 - F. It was an empire built through military conquest.
 - G. It was ruled by Sunni Ali and Askia Muhammad.
 - H. It was known for developing advanced weaponry.
14. Which of the following **does not** match the Hausa people of West Africa?
- F. They formed a savanna culture.
 - G. They were located on important trade routes.
 - H. They dominated the West African gold trade.
 - I. They developed powerful, independent city-states.
15. Which of the following **does not** describe the Yoruba people of West Africa?
- D. They were a forest civilization.
 - E. They spoke a common language.
 - F. They built the Ife and Oyo kingdoms.
 - J. They lacked a centralized form of government.
16. Which of the following **does not** describe the Benin people of West Africa?
- | | |
|---------------------------------|-------------------------------|
| F. encouraged artistic efforts. | H. was a savanna civilization |
| G. traded with the Portuguese. | I. was organized as a kingdom |

17. How did the rulers of Ghana grow rich?

- D. by taxing the goods traders carried through their territory
- E. by conquering neighboring kingdoms and taking their gold
- F. by building new trade routes to Asia
- J. by converting the country to Islam and appointing Muslims as advisers

18. Who was Mali's first great leader?

- E. Mansu Musa
- G. Sunni Ali
- F. Ibn Battuta
- H. Sundiata

19. What people broke away from Mali's empire and gained control of the all-important trade routes?

- E. the Hausa
- G. the Songhai
- F. the Yoruba
- H. the Almohads

20. Why was an empire never built by the Hausa city-state?

- F. People quickly left the area in search of a new source of salt.
- G. The Portuguese traders took over the area and enslaved the people.
- H. There was frequent fighting among the city-states.
- I. The African city-states could not agree on which religion-Islam or traditional African beliefs-to practice.

21. What is one way Sundiata helped the Mali Empire grow powerful and wealthy?
- E. He continued to conquer the neighboring empires, adding to Mali's power.
 - F. He kept a 100,000- man army to protect the kingdom from attack.
 - G. He made Timbuktu the most important city in the empire.
 - H. He promoted agriculture and reestablished the gold-salt trade.
22. How did Islam spread throughout Africa?
- E. It spread by conquest and through trade.
 - F. Muslim teachers traveled throughout Africa to introduce the faith.
 - G. Ibn Battuta traveled through 27 countries to teach the Qur'an.
 - J. Universities were established to teach the religion.
23. How did the empires in the Sahel grow strong?
- D. by converting to Islam and building mosques
 - E. by conquering neighboring nations and increasing their empires
 - F. by controlling and taxing trade
 - H. by building walls around their empires to protect against attack

World History: Societies and Empires of Africa Posttest

Section (3) Eastern City-States and Southern Empires

Directions: Circle the letter A, B, C, or D that best answers each of the following questions.

24. The Swahili language is a mixture of Bantu languages and _____ .

E. Arabic

G. Persian

F. Indian

H. Portuguese

25. Most of the raw materials that exchanged hands in the East African trade came from _____ .

E. India

G. Africa

F. China

H. Portugal

26. The city-state of Kilwa became an important trading center mainly because of its location in relation to _____ .

E. India and southern Africa

F. eastern and western Africa

G. northern and southern Africa

H. the Indian Ocean and the Mediterranean Sea

27. The event that had the greatest effect on the growth of Islam in East Africa was_____ .

- E. the arrival of the Portuguese
- F. the increase of trade and commerce
- G. the enslavement of Africans
- H. the chaos and disruption of wars and conquest

28. What do archaeologists believe was main intention of the Great Enclosure of Great Zimbabwe.

- E. to defend the city
- F. to convince Africans to convert to Islam
- G. to hold enslaved persons awaiting shipment to foreign markets
- H. to impress visitors with the power of Great Zimbabwe and its rulers

29. The name Mutapa came from a phrase meaning_____ .

- G. gold
- I. conqueror
- H. salt mine
- J. slave holder

30. What did Africans mainly provide in the trade between East Africa and Asia?

- C. art works
- K. grains and produce
- D. manufactured goods
- L. raw materials

31. How long did Portugal keep their ports and cities on Africa's East Coast?

E. 5 centuries

F. 10 centuries

G. 1 century

H. 2 centuries

32. What did Portugal's initial interest in African mostly seem to concern?

E. Politics

G. Agriculture

F. Religion

H. Trade

33. Which of the following places did **not play** an important role in the African trade between 800 and 1500?

E. India

G. Persia

F. China

H. Russia

34. What city controlled trade routes and was the economic, political, and religious center of an empire?

E. Kilwa

G. Sofala

F. Great Zimbabwe

H. Mombasa

35. Why did Kilwa seize Sofala?

- E. to stop Indian traders from sailing there
- F. to control the overseas trade of gold from southern Africa
- G. to punish it for not practicing Islam correctly
- H. to control the trade routes that led to central Africa

36. Which of the following best describes the Portuguese attitude toward the Mutapa?

- | | |
|---------------|-------------|
| E. Admiring | G. Fearful |
| F. Meddlesome | H. Friendly |

APPENDIX G

STUDENT FOCUS GROUP INTERVIEW PROTOCOL

Student Focus Group Interview Protocol

Title of Study: Exploring the impact of electronic textbook tools on student achievement in world history.

Interviewer Name's: Cathy Bonner

Location: High School Media Center

Date: Fall 2010

Starting Time:

Ending Time:

Introduction: Thank you for agreeing to this interview. As you might recall the research will investigate how the use of the electronic edition (eEdition) world history textbook highlighting and animation tools impact achievement. Our discussion will remain confidential and in reporting my research findings pseudonyms will be used. A pseudonym is an alias such as using a letter for a name instead of the person's actual name. In that way your anonymity is maintained. I would also like your permission to tape our discussion, can I tape this meeting? The interview will last for approximately 60 minutes so it will end at _____.

Interview Questions:

1. How did the use of the (highlight, animation, or highlight and animation) tool(s) contribute to you learning the world history information?

Probes- Did the tool(s) (highlighting, animation, or highlighting and animation combination) make the information change in your thoughts? How sure were you that the information you highlighted or animated contributed toward answering the guided reading questions? If affirmative, how did you know the highlight or animation added to answering the question? Did you review your previous highlighting? If yes, why did you review? Was it useful to review the information you highlighted while reading? Did you change previously highlighted information? Why? Did you add more highlighting to previously highlighted information? Why? Did you replay animations? Why? When? How often? Did replaying the animations contribute to your understanding of what you read? If so, what did replaying contribute to understanding what you read? How did the use of the tool(s) influence your recall of the information? Do you have any particular memory of vocabulary, ideas or concepts you read? If so, can you share 1-2 things that you recalled? How does the use of the tool(s) compare with not using the tool(s)? What did using the tool(s) add to or subtract from your ability to understand what you read in comparison to not using the tool(s)? What type of world history information were you able to understand better due to your use of the tool(s)? Did the use of the tool(s) add to or detract from your enjoyment while reading the world history information? If so, can you provide an example? Did the use of the tool(s) add to or detract from your interest in reading the world history information? If so, can you provide an example? Did the tool(s) help to motivate

you or detract from your motivation to read the information? If so, can you share an example?

2. What were successes or difficulties you experienced with using the tool(s)? Were you motivated to start and to continue using the tool? What led to your motivation or lack thereof? Have you ever used this tool(s) before or a similar one? If so, when and why did you use the tool(s)? Can you please share some of the difficulties and or successes you experienced with using the tool during the study? Did the use of the tool(s) help you to understand what you read? If so, how did it help you? What particular characteristic of the tool(s) helped you to learn the information? Do you think electronic tools like highlighting and animation tools should be combined during reading? What do you think would be the advantages or the disadvantages to yourself and other learners if the highlight and animation tools were used in combination with each other during reading? What do you think would be the advantages or the disadvantages to yourself and other learners if the highlighting and animation tools were used separately from each other during reading? Would you use the tool(s) in the future? If so, when and why? Would you recommend the use of the tool(s) to a peer? Why? How does using the tool(s) compare to not using the tool(s)? Would you continue to use the tool(s) in your future learning tasks?
3. How would you describe your overall experiences with using the tool(s)? Probes: Was it a positive experience to use the tool(s) while reading world history? Would you be willing to try it again? Were you excited about the tool(s)? If so how? What characteristic of the tool(s) added to your experiences? How much time did

it take you to learn to use the tool(s)? Did the use of the tool(s) add additional time to the time you would normally spend in reading? If so, how much additional time do you think was expended in using the tool(s)? If you were able to use the tool(s) for a longer period of time (such as the entire year) in world history class how do you think it would impact your achievement in world history class? Would you learn more or less and why? What would prevent you from using the tool(s) in the future? Would you like to share any ideas that you think would be useful for improving the eEdition world history textbook tools that are available? Do you have any other ideas about the use of eEdition world history textbook in instruction?

Thank you very much for your time and the understanding that you have added to current research by participating in the study.

APPENDIX H

TEACHER FOCUS GROUP INTERVIEW PROTOCOL

Teacher Focus Group Interview Protocol

Title of Study: Exploring the impact of electronic textbook tools on student achievement in world history.

Interviewer Name's: Cathy Bonner

Location: High School Media Center

Date: Fall 2010

Starting Time:

Ending Time:

Introduction: Thank you for agreeing to this interview. As you might recall the research will investigate how the use of the electronic edition (eEdition) world history textbook highlighting and animation tools impact achievement. During our discussions I will use the term *tools* to refer to both the highlight and animation tools in the *World History: Pattern of Interaction*, unless I specify a particular tool by name. Our discussion will remain confidential and in reporting my research findings pseudonyms will be used. I would also like your permission to tape our discussion, can I tape this interview? The interview will last for approximately 60 minutes so it will end at _____.

Interview Questions:

1. How do you think the use of the Highlight and Animation tools contribute to students learning the world history information?

Probes- Do you think the tools made the information change in student's thoughts? If so, how and in what way(s)? Can you share student's actions that led to your opinion(s)? Do you think the information that the students highlighted or animated contributed toward them answering the guided reading questions? Can

you elaborate on instances that indicated students were struggling or succeeding academically by using the tools? Do you think students reviewed previous highlighting? Or replayed previous animations? Why? When? How often? Do you think students changed previously highlighted information? If so, do you think changing previously highlighted information benefit students academically? Do you think students replayed the animations? If so, do you think replaying the animations benefitted the students academically? If so, how do you think replaying the animations benefitted the students academically? How do you think the use of the tools influenced student recall of the information? Do you have any memory of student grasp of vocabulary, ideas or concepts while they used the tools? If so, can you share 1-2 things that you recalled?

2. Did you think students experienced difficulty with using the tools? If so, can you share your opinions? Do you think students were motivated during the study to use the tools? Can you provide any specific details that indicated student motivation? If no, what do you think motivated the students to complete the condition? What do you think contributed to student lack of motivation if it was evident? Have you ever used the tools before or used other textbook electronic tool(s) with students? Can you describe your experiences with using the tool(s) during instruction? Do you think the use of the tools helped students to understand what they read? If so, how does it or could it help students to understand what they read? What particular characteristic of the tools do you think helped students to learn the information? Did you identify a particular tool in the study that appeared to be beneficial or detrimental to students? If so, what

tool did you identify? Can you elaborate on the learning benefit or cost student encountered by using the tool? Do you think combining the various tools in instruction, such as combining the highlighting and the animation tools, could be advantageous or disadvantageous toward student achievement? How and when do you think combining the tools could be advantageous or disadvantageous in instruction? Do you think the type of learning task should factor in the use of highlighting and animation? If so, why and what type of learning task do you think lends most to the use of the highlight and the animation tools? Do you think the type of learner should factor in the use of highlighting and animation? If so, Why and what type of learner do you think would benefit most from the use of the highlight and the animation tools? In the future, would you use the tool in instruction? If so, when, why, and in what instructional capacity? Would you recommend the use of the tool to a peer or student? Why? How do you think using the tools compare to not using the tools during learning and instruction? Would you use the tools in future instruction?

3. What is your overall opinion on student's experiences with using the tools?

Probes: Do you think it was a positive experience for students? Why or why not? Do you think students would be willing to try the tools again? Do you think students were excited about learning to use or using the tools? Can you provide any details to show that students were interested or excited about using the tools? What characteristic of the tools do you think added or distracted from the student's learning experiences? How much time do you think it takes children to acclimate to using the tools? Why do you think X (time) is needed to acclimate

students to using the tools while reading information? Do you think the use of the tools added additional time to what students would normally spend during reading tasks? If so, how much additional time do you think was expended in using the tools? What do you think accounted for the additional time? What would prevent you from using the tools in the future for instructional purposes? Would you like to share any ideas that you think would be useful for improving the eEdition world history textbook tools? Do you have any further ideas about the use of eEdition world history textbook tools in instruction?

Thank you very much for your time and the understanding that you have added to current research by participating in the study.

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