AUGMENTED REALITY EMBEDDED IN HISTORICAL FICTION HARD-COVER BOOKS TO ENHANCE COMPREHENSION IN HISTORICAL CONCEPTS

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by
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ABSTRACT

This qualitative comparative case study builds upon previous research on the use of augmented reality (AR) and how it can be used as a technology scaffold in education by embedding AR in physical books to assist students in reading material to better comprehend content. This study particularly focuses on the discipline of history, but attempts to remain open so as to inform reading in any discipline. This study argues the potential benefits for using augmented reality as a tool for scaffolding student’s reading comprehension of subject matter texts, which in turn may give them a deeper understanding of the concepts and events. This comparative case study focuses on students in two social studies classes in seventh grade. One class received AR embedded in two historical fiction books and the other class did not. Student reading comprehension was measured by changes in pre and post concept maps and strategies evident in student discourse and observations. By providing students with these AR-based technology scaffolds, the findings show that students’ collaboration increased during the reading activity, and their discourse demonstrated comprehension. The results of the pre and post concept maps did not yield interpretable results in terms of improvements in reading comprehension or learning historical concepts.
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Chapter 1

Introduction

State standardized testing had become more rigorous and important in American education when President George W. Bush passed the No Child Left Behind (NCLB) act in 2002 (United States Department of Education, 2006). Whilst this research was taking place, No Child Left Behind was still in effect. Within the last few months President Barrack Obama has instituted the Every Student Succeeds Act (ESSA). The ESSA puts less emphasis on standardized testing, and gives states more of a say of how they will assess student learning (Every Student Succeeds Act, 2015). The state of Virginia’s standardized test, The Standards of Learning (SOL), is still given to all students in their core classes (Social Studies, Science, English, and Mathematics) between third and twelfth grade (Virginia Department of Education, 2014).

A commonly-seen issue with the SOL is that even if a student fails the standardized exam, they still progress to the next grade where they are faced with the challenge of passing a more advanced-level SOL exam. Because of this, students may be falling behind without any way of catching up; teachers may feel constrained to differentiate instruction enough to enable all students to progress to the level where the state mandates they should be; and administrators may feel pressured by the school board, community, and state’s department of education when these students fail. Using scaffolds to assist students in reading material in order to learn critical historical concepts
and topics may help students in reaching a level of reading that will set them up to be successful in learning specific content.

With the current testing system in Virginia, a large number of students still go through school without learning to comprehend what they read beyond a rudimentary level (Baker, Gersten, & Grossen, 2002; National Reading Panel, 2000; Snow, Burns, &Griffin, 1998). Core subjects, such as social studies and science, require students to be able to read and understand grade-level textbooks and other course-related material to learn. This puts students who are unable to read at grade level at a severe disadvantage in subjects like social studies and science. They are now not only expected to know how to read proficiently, but to read at an advanced level. Unfortunately, students who are unable to comprehend what they are reading are severely at a disadvantage in their education regardless of the subject.

A number of studies have suggested the advantages of using mobile devices for learning (Chen, Kao, &Sheu, 2003; Chen, Teng, Lee, Kinshuk, 2011; Denk, Weber, & Belfin, 2007; Pea, 2004). This study intended to focus upon the possibility of using mobile devices in combination with augmented reality to create scaffolds embedded within physical history-related narrative books to support students with their learning and understanding of historical concepts.

**Theoretical Framework**

This study aims to demonstrate how augmented reality might improve reading comprehension to learn history concepts through the theoretical lens of scaffolding.
Vygotsky’s socio-cultural theory first described scaffolding (Vygotsky, 1978). Scaffolding was then formally defined by Wood, Bruner, and Ross (1976) as a “process that enables a child or novice to solve a problem, carry out a task, or achieve a goal which would be beyond his unassisted efforts” (p.90). In other words, scaffolding allows a teacher or peer to assist a learner in learning material that would ordinarily be beyond their ability without any guidance. In education, scaffolds are added based on a student’s needs. As technology has advanced, it is accepted that scaffolds can be in the form of a tool, such as technology (Azevedo, Cromley, & Seibert, 2004; Devolder, van Braak, & Tondeur, 2012; Greene & Land, 2000; Huang, Wu, & Chen, 2012; Kim & Hannafin, 2011; Pea, 2004; Quintana et al., 2004; Zhang & Quintana, 2012). As a student progresses, the scaffolds are modified, ideally fading away once the student demonstrates independent understanding of the skill or material (Sawyer, 2006).

This research study used the theoretical framework of scaffolding to study the use of augmented reality embedded within books. Students often struggle with reading comprehension, making it difficult for them to learn important information about a particular subject if it is conveyed in text (Allor, Mathes, Robers, Cheatham, Otaiba, 2014; Baker et al., 2002; Morris, Brush, & Myers, 2007; Palincsar & Brown, 1984; Teng, Chen, & Lee, 2011; Wei Blackorby, & Schiller, 2011). In the past, text was simplified as a way of alleviating this problem (Baker et al., 2002). However, if a text is “watered down” instead of embedded with scaffolds, then the idea of universal education quality is compromised (Baker et al., 2002). Instead, using augmented reality to scaffold a student’s ability to comprehend text may help students to pull out lessons about history or another
discipline from within the text, forming a deeper understanding without simplifying the material.

**Problem Statement**

Students are often instructed to read a narrative book in order to learn historical concepts and events. However, history teachers are not typically instructed on how to teach reading. When these teachers assign reading to teach content, they do not focus on assisting students with reading comprehension (Richardson, Morgan, & Fleener, 2011). While this may seem reasonable, as a history teacher’s job is to teach history, not literacy, it is problematic when put into context with current trends in student reading comprehension.

Research conducted on scaffolding has suggested that it can help students to bridge this gap between reading and knowledge acquisition to aid them in attaining their educational goals (Bransford, Brown, & Cocking, 2000; Palincsar & Brown, 1984). Quintana et al. (2004) found that technology-based scaffolds in particular may help students in a classroom setting. However, studies using mobile devices and augmented reality are still in their infancy; little is understood about how students can use technology-based scaffolding techniques in practice to help them attain their goals in reading to learn content. This study investigates and informs the literature on how mobile devices and augmented reality can create scaffolds that assist students with reading comprehension to enable them to learn a discipline, specifically history, embedded in text.
Research Purpose

Studies have shown that students with comprehension problems often have difficulty in distinguishing between essential and nonessential material (Baker, Gersten, & Grossen, 2002; Taylor & Williams, 1983). The purpose of this research study is to assist students by introducing scaffolds in their history reading material to highlight the essential material, improve student engagement, focus student attention, reflect upon the material, and support them in connecting the material to prior knowledge. The framework for this study was derived from the work done by Quintana et al. (2004), Palincsar and Brown (1984), and Goldman (2012). Quintana et al. (2004) created a scaffolding design framework for science inquiry, and although this study is not based in science education, it does borrow a few design strategies. Quintana et al.’s (2004) framework for technology scaffolds contains three constituent processes: 1) sense making, 2) process management, and 3) articulation and reflection. Each part is then broken down into different guidelines, and these guidelines were used to create the augmented reality scaffolds (see Table 3.1). Palincsar and Brown (1984) designed scaffolds using a framework of reciprocal teaching for reading comprehension. They explained that it is widely acknowledged that comprehension in reading occurs from prior knowledge and the content of the text. The main strategies outlined by Palincsar and Brown includes: summarizing, questioning, clarifying, and predicting. These four strategies assist students in the six occupations that Palincsar and Brown (1984) found are common in mature readers in their reading habits: Understanding the purpose of reading, activating relevant background knowledge, allocating attention to important content,
critical evaluation of content for consistency, and metacognition (Palincsar & Brown, 1984). Finally, Goldman (2012) identified five characteristics that make a successful reader: 1. Successful readers use a range of strategies when they realize they do not understand what they are reading, 2. A successful reader is able to explain concepts in the text and relate different concepts within a text to each other and to prior knowledge, 3. Successful readers sometimes generate self-explanations during reading, ask questions that probe the connections among parts of the text, or seek explanations, 4. They use cues to the logical organization of a text to guide their comprehension, and 5. They rely on multiple types of knowledge (for example, knowledge of words, concepts, sentence structures, text structures, genres) as they try to interpret print.

The present study adapts aspects of these three frameworks by providing technology-based scaffolds for reading comprehension in order to read to learn the discipline of history: 1) prior knowledge, 2) questions prompts, and 3) corrective feedback (see Table 2.2). The strategies are covered in more detail under the literature review and methodology sections of this study.

In addition to highlighting essential material, this research aims to determine how to use scaffolding in history texts to reduce the reading demands by adding questions that encourage students to think critically about the concepts and events being conveyed. Analyzing the effects of these changes via students’ discourse was conducted to provide insights into how students comprehend the learning and engage in the material; student growth via pre and post concept maps was used in order to determine to what extent the augmented-reality scaffolds affected the student’s understanding of the historical topic.
Research Questions

1. What kinds of comprehension strategies are evidenced in the discourse between pairs of students while reading historical fiction?

   - Are there different qualitative patterns of the discourse between groups of students who receive embedded, augmented reality scaffolds of reading comprehension strategies and those who did not receive the scaffolds?

2. How does the addition of embedded augmented reality scaffolds in reading material affect student reading comprehension and understanding of a concept or event as measured by an analysis of pre and post concept maps, and by analyzing discourse? Specifically, what effects can be observed both through these changes and by comparing the maps and discourse of students who received the scaffolding with those who did not?
Chapter 2
Review of the Literature

The research questions for this study were developed to address a gap in the literature focusing on reading comprehension, social studies education, technology scaffolding, augmented reality, and reading to learn discipline. National reports have revealed that there is a deficit in students’ abilities to read after high school (Paris, Wixson, & Palincsar, 1986). After delving into the research on the following topics it was discovered that improving students’ ability to learn subject material from text is a goal that may be attained through technology scaffolds to improve reading comprehension. Assisting students in their reading comprehension by aiding them with technological scaffolds, such as augmented reality, may attain this improvement.

Reading Instruction

Over the last forty years, there has been a long debate on how to best instruct children to read (Pearson & Gallagher, 1983). Reading needs to be active to allow readers to purposefully construct meaning beyond what is stated, and to allow the reader to create relevant knowledge that can be integrated within his or her prior knowledge (Chen, Teng, & Lee, 2010). Traditional ideas regarding reading instruction posit that readers are acquiring a set of skills and subskills that build toward comprehension ability. In this view, readers are merely passive recipients of information from the text (Dole, Duffy,
Roehler, & Pearson, 1991). A cognitive-based view of reading comprehension instead emphasizes the interactive nature of reading (Dole et al., 1991; Rumelhart & Ortony, 1977). Readers are expected to use their existing knowledge along with cues from the text itself partnered with the situational context in which the reading occurs to build meaning from the text (Dole et al., 1991; Palincsar & Brown, 1984; Rumelhart & Ortony, 1977). Readers bring prior knowledge to each passage, and that knowledge is paramount to understanding the literature. Novice and expert readers alike use existing knowledge as a filter to interpret and construct meaning of a given text (Dole et al., 1991).

Reading comprehension is the goal of reading. The RAND Reading Study Group (2002) describes comprehension as the process of “simultaneously extracting and constructing meaning through interaction and involvement with written language” (as cited in Chen, et al., 2010). There is a great deal of consensus on the four main factors for comprehending text: decoding fluency, considerate texts, compatible content, and strategic activity (Chen, et al., 2010; Palincsar & Brown, 1984). Researchers have found that mature readers often question and elaborate their own knowledge into the content of the text and test their understanding by thinking of counter examples and testing generalizations. They apply the new found knowledge to the universe and use debugging ploys that force them to correct misunderstandings (Palincsar & Brown, 1984). The scaffolds developed for this study strive to move novice learners into becoming mature readers, by scaffolding reading in a way that eventually the three factors will become natural to the learner.

Palincsar and Brown (1984) concluded that students should use four activities to help engage themselves in their reading. These four activities are: summarizing,
questioning, clarifying, and predicting. This study designed scaffolds to encourage these activities to assist student learning and they also served as a coding scheme for student discourse, to determine if the scaffolds are reaching their intended goal. Palincsar and Brown (1984) broke these four activities down further into six occupations that are common in mature readers in their reading habits: Understanding the purpose of reading, activating relevant background knowledge, allocation attention to important content, critical evaluation of content for consistency, and metacognition (Palincsar & Brown, 1984). These six occupations are not in the current coding scheme, but were considered when analyzing transcriptions and when taking field notes. Coiro and Dobler (2007) articulated similar elements they found required for reading comprehension: 1) learner must have prior knowledge, 2), inferential reasoning, 3) self-regulation while reading, and 4) affection related to efficacy and motivation (as cited in Chen, et al., 2010, p. 201). Problems in reading comprehension then are often the result of a lack of prior knowledge, inability to make inferences, and/or problems in self-regulation while reading. The reader then needs to turn to other resources to make up for the deficiency (Chen, et al., 2010).

The augmented reality books developed for this study include activities to assist students in these difficulties and assist students who may have problems with any of the four elements needed for comprehension, by either giving students some background prior to reading the section, and/or by providing assistance when they need to make inferences.

This study also scaffolds the reading material in a way to assist students in self-regulation and motivation (Chen et al., 2010; Devolder, van Braak, Tondeur, 2012; Ge, 2013; Zimmerman, 2002).
Reading Instruction within the Discipline of History

This study aims to conduct research, not in an English class where students generally focus on reading comprehension, but instead in a Social Studies class. It is of major concern that literacy skills and training take place outside of content - that is, students are not learning to read or write to learn content (Fry 2009; Goldman, 2012; Halvorsen et al., 2012; MacPhee & Whitecotton, 2011; Monte-Sano, 2015). Halvorsen et al. (2012) discuss that “without sufficient classroom time devoted to teaching foundational knowledge and skills in social studies early on, students are at risk of not developing the characteristics necessary for full and effective participation in a democratic society” (p. 199). These sentiments are echoes of those by the National Council for the Social Studies (NCSS), who recognize the roles of the social studies teacher shifting to teach the skills of content literacy, as well as digital literacy (NCSS, 2013).

Despite these concerns, teaching reading and writing skills often happens in isolation instead of within the context (Fry 2009; Halvorsen et al., 2012; MacPhee & Whitecotton, 2011), yet promising results have been seen when these skills are taught and practiced within the social studies discipline. MacPhee and Whitecotton (2011) found that students felt they learned better using literacy as a tool to support the construction of content knowledge. Halvorsen et al. (2012), who used a project-based learning framework, demonstrated how using innovative technologies as a conduit to learn social studies not only assisted students in learning content, but also engaged them in the learning process and expanded their literacy skills.
Pace’s (2012) evaluation on teaching literacy in social studies education has shown a negative side of integrating social studies instruction and how this has been heavily influenced by the No Child Left Behind Act. Although Pace (2012) recognizes the need for reading comprehension skills in order to obtain content literacy, she is concerned that when the focus is on teaching literacy skills within the social studies class time there is a shift in the focus away from actual content. Through her study at an elementary school, she found that this practice actually distanced students from history rather than support their understanding of it. Despite these negative findings, this research helps inform this study, by showing a need for different approaches to social studies teaching that balances history and literacy instruction. This study looks not only at using augmented reality as a technology scaffold (see next section) to assist students in reading comprehension, but it attempts to evaluate student structural knowledge on historical concepts and events.

Scaffolds

The scaffolding framework in this study was derived off of frameworks already constructed by Quintana et al. (2004), and Palincsar and Brown, (1984). This study delves deeper into these two frameworks by looking at more recent work conducted in technology scaffolding, self regulation, and reciprocal teaching done by Zhang and Quintana (2012), Ge and Land (2003), Ge (2013), Chen, Kao, and Sheu (2003), and Freeman (2012).
Ge and Land (2003) focus their research on ill-structured problem solving, which involves working on problems that are complex, ill defined, open ended, and real world. This research study partially developed its scaffolds based on Ge and Land’s (2003) conceptual framework on scaffolding for ill-structured problem solving due to the open-endedness of the problem of reading comprehension, and because of this study’s connection to real life - both on a level of learner’s reading abilities and on historical concepts. This framework recognizes the issue that learners sometimes fail to monitor understanding and progress when trying to solve a problem, which follows Palincsar and Brown’s (1984) research reflecting that reader’s often fail in comprehension when they do not have prior knowledge, and fail at metacognition techniques while reading.

This research looks to assist students in both cognitive and metacognitive skills through the use of scaffolds. Scaffolds are seen as adjustable and temporary and include support that does not involve explicit humanlike guidance. Instead, scaffolds can be cue cards, procedural prompts guided peer questioning, or techniques such as reciprocal teaching (Ge & Land, 2003; Palinscar & Brown, 1984).

Ge and Land (2003) broke their framework down to four types of problem solving processes: Problem representation, generating or selecting solutions, making justifications, and monitoring and evaluating. Because this study focuses on reading based on historical events, we focus on two of the pieces of the framework: problem representation, and monitoring and evaluating. The following is a description taken from Ge and Land (2003) framework:
Table 2.1: Types of Question Prompts Used Based on Ge and Land’s (2003) Framework

<table>
<thead>
<tr>
<th>Problem Solving Process</th>
<th>Type of Question Prompt and Specific Function</th>
<th>Examples</th>
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</thead>
</table>
| Problem representation  | Elaboration Prompts:                        | - What information is missing  
- Elaborating thoughts  
- Eliciting explanations | - How are…interrelated to each other?  
- What do you think are the primary factors of this problem?  
- Why is it…? Please explain.  
- What does…mean? |
| Monitoring and evaluating| Reflection prompts:  
- Monitoring and evaluating | - What are the pros and cons of the solution?  
- Have I thought about alternative solutions?  
- Have I identified all the constraints?  
- Have I taken into account the perspective of different stakeholders?  
- Am I on the right track?  
- What could have been done differently?  
- What would be the side effects? |

Chen, Kao, and Sheu (2003) developed a mobile learning system for scaffolding student learning about bird watching. Chen et al. (2003) explore the possible roles and scaffolding aids that the mobile learning device offers. They also investigate whether student's benefited from the mobility, portability, and individualism the devices offered. This study describes six benefits they found for mobile learning. While this study does not focus on the portability of the device due to the augmented reality piece being vision-based, not location-based (Dunleavy, 2014), three of the benefits are still valid: 1) interactivity of the learning process, 2) situating of instructional activity, and 3) integration of instructional content. The AR books that are being designed in this study depend on making the learning process more interactive, situating the knowledge by
using question prompts and connections, and integrating and connecting historical concepts not expressly described in the book.

Two things that Chen et al. (2003) focused on in their design in scaffolds were repetitive authentic practice and ongoing assessment. This study in AR books had students read three books, and mimics Chen et al.’s (2003) suggestion about ongoing assessment. Before each book, students completed a pre-concept map. During the activity students were given question prompts, in which their answers were be recorded. Student answers to these prompts were not analyzed, but they help prove that scaffolds were being utilized during the study. At the end of each book students created a post-concept map. Chen et al. (2003) found that children who used their scaffold model did improve their learning above and beyond what was expected.

**Types of Scaffolds**

Scaffolds can be broken down and delineated by the delivery method, such as embedded or non-embedded, static or adaptive, interactive or dynamic, explicit or tactic, and hard or soft (Devolder, van Braak, & Tondeur, 2012; Fecich, 2014). Devolder, van Braak, and Tondeur (2012) breaks down the different scaffolds in the following way:

- **Embedded**: Rooted in activity in a way that students must acknowledge them.
- **Non-embedded**: dependent on student goals
- **Explicit**: a more direct tactic
- **Static**: stable, fixed, and unchanged
Adaptive: a scaffold a student can alter and will differ depending on student response

Hard: Usually utilizes technology, and focuses on learning basic information

Soft: Adjustable and are provided by expert teacher or peer

Interactive/Dynamic: allow for interactive assessment and corrective feedback

The three main types of scaffolds are conceptual, instructional, and technological according to Quintana et al. (2004) all three types of scaffolds are utilized in this research, and are described in detail below.

Conceptual Scaffolds

This research study uses several conceptual scaffolds, which are used to direct the learner during the activity in regarding what to think about and consider. Prompts, think alouds, and cues all serve as conceptual scaffolds, and are included in this study (Azevedo, Cromley, & Seubert, 2004; Fecich, 2014; Hannifin, Land, & Oliver, 1999; Hill & Hannafin, 2001; Huang, Wu, & Chen, 2012). Palincsar and Brown (1984) conducted research specifically on how reading comprehension can be benefited by using reciprocal reading strategies, which are scaffolds provided by teachers and students during reading. This research moves past this by taking these scaffolds and embedding them inside a book, and allowing them to be used with technology rather than a teacher or peer scaffold.
Instructional Scaffolds

By aiding students in focusing on elements of an activity that they can master and guiding them through more difficult tasks, we are applying instructional scaffolds (Fecich, 2014; Schunk, 2008; Xun & Land, 2004). The strategies identified by Freeman (2012) that were pulled out and adapted for this study include the following: 1) provide understandable content without oversimplifying, 2) use direct teaching for learners to understand new terminology, such as text-to-speech, and read aloud functions, 3) give students prior knowledge before reading a section 4) give purposeful feedback, and 5) break pieces of the book into more manageable pieces.

Technology Scaffolds

This research study seeks ways to use technology and embed it into historical fiction books as technology scaffolds. Quintana et al. (2004) defines scaffolding as the “process by which a teacher or more knowledgeable peer provides assistance that enables learners to succeed in problems that would otherwise be too difficult” (p. 338). The concept of scaffolding has been adopted to include technological supports for learning, as software tools can support learners, by providing structure for complex or difficult tasks (p. 338).

Quintana et al. (2004) describes how software tools can transform tasks for learners. The software tool can be a model of how performance and complex tasks can be distributed, by providing assistance at opportune moments. It may also help learners accomplish tasks within their Zone of Proximal Development, as it provides assistance to
learners to accomplish tasks more complex than what they could do alone and have them learn from that experience (Quintana et al., 2004, p. 340; Vygotsky, 1978). This research will focus on augmented reality and mobile technologies as a software tool to scaffold learning. In particular this research will focus on the way that augmented reality can transform tasks in ways that lead to greater success in comprehending history contexts while reading historical fictional narratives.

The augmented reality scaffolds needed to be created in a way to ensure student learning. Zhang and Quintana (2012) discuss why a student having simple access to the Internet does not always facilitate learning. They break down the reasons into three categories: 1) Superficial engagement with content, meaning students try to simplify tasks to find answers rather then using sense-making or problem solving skills, 2) Inefficiency in online inquiry cased by disorientation, distraction, poor search skills, and mechanical tasks, meaning students waste time and effort on irrelevant tasks, and 3) poor self-regulation. Students need to proactively plan and self monitor in online inquiry, and research suggests this is not happening (Zimmerman, 2002; Greene & Land, 2000). This study aims to create scaffolds using augmented reality and online resources in a way to try and avoid these problems. Kim and Hannafin (2011) explain that there is a lack of research on scaffolding learning in a real-world classroom setting (as cited in Zhang & Quintana, 2012, pg. 182). This research attempts to fill the gap by researching scaffolding in a real classroom using technology.

As one of the underlying goals of this research is to see how augmented reality can transform everyday learning tasks for students, Quintana et al.’s (2004) framework on scaffolding was adapted to work in a social studies education setting. The following
Table 2.2 Scaffolds Used to Inform the Design

<table>
<thead>
<tr>
<th>Strategies and scaffolds used during augmentation</th>
<th>Research Supporting Concept</th>
<th>Implementation in this study</th>
</tr>
</thead>
</table>
| Scaffold 1: Prior knowledge                      | Students will comprehend reading better if they hold some prior knowledge on the material (Ge and Land, 2003; Palincsar and Brown, 1984) | - Before reading the book students scanned the cover of the book and see a short informational video on the overall topic. These videos were created using Edpuzzle.com, because you can add in interactive questions, and comments, and monitor student engagement.  
- When a concept was brought up in the book that requires some knowledge of the historical era, students scanned the augmented picture and watch another short video, prior to reading the passage. For example, in *Birmingham, 1963* there was a need to understand Dr. Martin Luther King Jr. involvement in Birmingham, although it was never directly addressed in the book. Students watched a video on King’s visit to Birmingham before reading the passage alluding to his visit. These videos were also created using edpuzzle.com, because you can add in interactive questions, and comments, and monitor student engagement. |
| Scaffold 2:                                      | Students were given                                                                       | - Each augmentation included an activity                                                                                                                     |
Question prompts | questions to assist them in elaborating thoughts, eliciting explanations, articulation, and sense making (Ge and Land, 2003; Quintana et al. 2004) (see Table 2.1). The questions asked were presented before and after reading (Fecich, 2014). | that students had to conclude to move on. Most of these were simple questions that forced the student to reflect on what they have read. These were created with both edpuzzle.com (because you can add in interactive questions, and comments, and monitor student engagement) and Google forms, so I could easily collect and assess student responses.

| Scaffold 3: Monitoring activities | Scaffolds will need to assist learner in monitoring ongoing activities to see if comprehension is occurring (Palincsar & Brown, 1984; Zhang & Quintana, 2012; Quintana et al. 2004). | - Augmentations included periodic reviews. For example, students were asked to create screencasts in order to help them create and feel some connection to the content. In order to do this students were asked to create screencasts throughout the book to review what was taking place from multiple perspectives. These screencasts were used using an app called Screenchomp. This was selected because of the ease of use and sharing on screencasts.

| Scaffold 4: Corrective feedback | Students were usually given immediate purposeful feedback based on research done by Freeman, 2012, and Fecich, 2014. The feedback will need to be meaningful and explicit (Freeman, 2012; Fecich, 2014). | - Throughout the book students were asked questions, and they needed to demonstrate what they learned and the connections made. Students received immediate feedback from these questions – for example on the edpuzzle videos, students were asked questions immediately, and edpuzzle let them know if they were wrong, which was the correct response, and why.

Beyond the above framework, Hill and Hannafin (2001) describe four major components of scaffolds: conceptual, metacognitive, procedural, and strategic. This study
looks to address these four components within the above framework. The following table describes each scaffold mechanism, and how they were addressed in the scaffolds listed in Table 2.2:

Table 2.3 *Hill and Hannafin’s (2001) Scaffolding Mechanisms*

<table>
<thead>
<tr>
<th>Scaffolding Mechanism</th>
<th>Description</th>
<th>How it’s embedded in the scaffolds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual</td>
<td>Assist learner with defining what to consider</td>
<td>This mechanism is embedded prior knowledge scaffolds, as well as question prompts. Both highlight what the student needs to know, and he or she needs to consider in the text.</td>
</tr>
<tr>
<td>Metacognitive</td>
<td>Assist learner in what they know and how to think</td>
<td>This mechanism is embedded in the monitoring activities scaffolds. The periodic reviews that were used allow students to go through what they know by asking them to describe it in a screencast.</td>
</tr>
<tr>
<td>Procedural</td>
<td>Assist learner in how to use the resource</td>
<td>This mechanism is used in both question prompts, which highlights what they should be focusing on in the resource, as well as in corrective feedback, which assist learners when they are not focusing on the correct piece of information, or misinterpreted information from the resource. For example, in the videos created with edpuzzle.com, students need to answer the embedded questions correctly. If they do not, they are given information about what the correct answer should be, and what they should have focused on in the reading instead.</td>
</tr>
<tr>
<td>Strategic</td>
<td>Assist learner by showing them an alternative way to do a task</td>
<td>This mechanism was used when trying to create and promote a connection to the material. Students were asked to not only reflect on the main characters perspectives, but also the subgroup of people. For example, in <em>Home of the Brave</em>, students were asked to create a screencast from the perspective of the Japanese-Americans, but then they had to create a second screencast from the perspective of the Americans that pushed for the interment camps. Having students look at the other perspective showed them a new strategy to reading historical fiction.</td>
</tr>
</tbody>
</table>
Augmented Reality

Klopfer (2011) describes augmented reality as a real world environment with an overlay of virtual information. This study looks to assist learners through the union of social studies education, mobile learning, and augmented reality (Schrier, 2006). The following research has helped put forth the different ways this union can take place.

This research study starts by taking a look at how to design AR simulations to scaffold learning. Dunleavy (2014) describes three design principles for AR simulations: 1) Enable and then challenge, 2) Drive by gamified story, and 3) See the unseen.

Dunleavy (2014) discusses the importance of enabling learners to access and process content, in a way that prevents student cognitive overload, but then to challenge students with higher-level problems. This study then delineates further on how to do this by a) creating a simplified experience that increases in complexity as the activity continues, b) scaffolding each activity in a way that enables the learner to achieve the desired behavior, c) replace text with audio, and d) use videos containing narrators that are the same age as the learners.

The second principle for augmented reality learning design is to have the augmentation be driven by gamified story. Dunleavy (2014) regards this as giving learners a narrative or interactive story to interact with. This study already is taking a built narrative (the historical fiction), and embeds the AR components into the physical book making it more interactive. This study does build something that can be seen as a video game per say, but it does include elements of a gamified story.
The third design principle developed by Dunleavy (2014) is to allow the learner to see the unseen. Dunleavy (2014) gives an example of a learner pointing their mobile phone at a sign, to see a 3-dimensional model coming into view in the augmented reality browser. This research study uses this in the augmentations developed out still frame pictures in physical books. It will allow learners to see the unseen, but showing them more about the story, and about the historical concepts that the picture is depicting.

Although this research study revolves around vision-based augmented reality and not location-based (Dunleavy, 2014), a review of the literature of location-based studies has been beneficial to the development of this study. As part of their research in the social science of geography, McGreen and Sánchez (2005) advocate the use of mobile phones during fieldtrips to museums or historical monuments suggesting that mobile phones can promote collaborative learning that benefits the learner. They spent two days following two students that had just gone through a lesson on reading maps and symbols. When the day of the challenge began, the students were brought to the starting point, they logged into the smartphones and found their way through the town with parent observers (p. 216). Using smartphones, these students’ task was to mark places of interest on a street map while they walk around. The entire challenge was documented, with data collected through interviews, observations, and post-questionnaires given to the participants as well as the parent observers. Transcripts were created of the communication between the teams during the challenge (p.216).

This study provides one example of how mobile learning can take place easily within the context of a simple social studies mapping exercise. Map skills are a fundamental part of many lessons in social studies classes and with the increasing
popularity of smartphones students can use their personal mobile phones to learn and apply these skills, which reinforces the real-world applicability of such devices.

McGreen and Sánchez (2005) concluded that there are many possible uses for mobile phones in such learning contexts and that their participants engaged and collaborated well, as all completed the challenge and received maximum points for the exercise. As it offers great potential to students, as well as teachers it is hoped that mobile phones become more broadly accepted as learning tools.

Tan and So (2011) conducted their AR research in the field of geography. Theoretically they focused on Brown, Collins, and Duguid’s (1989) research on “Situated Cognition and Cultural Learning” as well as the Lev Vygotsky’s (1978) social-constructivist approach, described as an active process of building knowledge and skills through practice. Such active skill building is most effective within a supportive community (Tan & So, 2011). Their study included 12 students split into three separate groups; members were randomly assigned based on gender and academic achievement. Video and audio recordings of the participants were transcribed and coded for two dimensions in the knowledge construction process; epistemic and the social. They had students in one secondary school in Singapore use MacBooks and Google Maps to discover key information on a geography trail, concluding that activities conducted in situ (meaning on-site) utilizing mobile technology “should be considered to be supportive of meaningful collaborative learning practices in mobile learning” (p.41).

With the application of augmented reality to the social science, this research clearly documents the integration of mobile technology within social studies education. Although this particular case study focused on geography, students were also required to
use math and science skills in order to ascertain other information, such as slope. Tan and So (2011) found that the integration of facilitation, in-situ activities, and technology in their design supported meaningful collaboration in mobile learning. Their analysis also documents that the presence of an authentic setting could help learners to generate knowledge co-instruction, even for more mundane performative tasks. In spite of the study’s generally positive results, one negative aspect reported was that learners had a difficult time taking the concepts learned in the classroom and applying them to a real geography trail. Their knowledge didn’t transfer from the classroom into a real-world context. This negative result is significant, and indicates need for situated cognition learning strategies. We found a similar negative effect in the implementation of augmented reality book in social studies education, and suggest further iterations of this study find ways to scaffold books using AR so that students are better able to connect the historical concepts presented in the book with current and past events (see Chapter 5). One of the goals of this research is to use these augmentations inside the book to help bridge that gap between what they are learning in school and the real world.

Kretschmer et al.’s (2002) conference proceeding, “Meeting the Spirit of History”, situates augmented reality research within a history lesson framework. Including AR and digital interactive storytelling, through head-mounted display, these researchers proposed a study and suggested an augmented historical sightseeing tour in a castle and “olde town” in Heidelberg, Germany. Developed by Fraunhofer-IGD in Darmstadt, Germany, the head-mount displays were semi-permeable glasses that augmented reality. The castle and “olde town” were to be augmented as a backdrop for a story that involved the spirits of bellicose neighbors from Palatinate and France –
lovesick romanticists and poets suffering from heartaches and turmoil of the Thirty Years’ War who were fighting for property and power. Without data collection or analysis Kretschmer et al.’s (2002) proposed study is still theoretical, although it provides a usable example of how augmented reality can work within social studies education.

Schrier (2005) conducted two trials for the project "Reliving the Revolution." The first of these involved a mix of eight individuals – graduate students and local educators – aged 26 to 41. The second trial included six graduate students, aged 24 to 31. After these two trials the AR experiment was redesigned and renamed “Redesign Trial.” The third trial involved eight individuals aged 13 to 17, all of who attended high school. This group of learners went to Massachusetts to rediscover the truth about what happened during the Battle of Lexington from the American Revolutionary War. Their task was to discover who had fired the first shot that infamously started the war. The learners utilized mobile handheld computers (specifically PocketPC by Dell) that conveyed location-based "virtual" information. The PocketPCs used a Global Positioning System (GPS) to trigger this information, depending on where the participant was standing. In these trials learners interacted with famous historical figures, gathering clues to deduce who had fired that initial shot. Working in pairs, learners were assigned to play the entire game as one of four different historical figures. From these different vantage points, participants interpreted clues and formed their own conclusions.

Schrier (2005) used ethnographic research methods to collect and analyze data. Data was collected via videotape and in-person observations, from notes taken by each participant during the game, and by pre-game and post-game surveys. The theoretical frameworks of sociocultural, and situated cognition served as a base for this research.
This was achieved by having the learners mimic the activities of a historian. The research also relied heavily on location-based learning strategies.

The data collected was coded according to participants’ attention, interest, and enjoyment levels, as well as their mood and level of activity and analyzed to deduce whether or not the game had supported social interactions, encouraged group problem solving, and supported the communication of ideas. The participants’ response to “Reliving the Revolution” was overwhelmingly positive. Nearly every learner enjoyed being at the site, stating that it “made history more real” (p.124). This research, like Tan and So (2011), demonstrated that mobile learning facilitated more social interactions, enriching participants’ overall experience. This is a finding that is mimicked in our research study. Many of the participants felt that being in the actual place where these events occurred gave them greater insight as opposed to playing a virtual game on a desktop computer. Indeed, one student in particular favorably recounted that,

I re-learned U.S. History One, which is what I took sophomore year of high school, and it was a total waste of my time. And I just re-learned it in three hours, which is kinda scary...But this recapped it and I relearned it and now I know more about history...the pictures and the items [helped make it clearer] (p.130).

This experiment gave participants a sense of ownership of the material learned. Since they were able to play the part of historians, engaging and solving an actual mystery from the past, they felt that their opinions truly mattered. One student expounded on how they felt more involved in history, explaining that, "[The game] put you in the real place where everything happened. It gave you the real, actual people who
were there, like the names and their opinions" (p.134). Although this study does not give students as much of a connection to place, Schrier’s (2005) study does give some insight as to how augmented reality may draw more empathy from learners for historical events.

In response to the conference held by the National Technology Leadership Initiative (NTLI) van Hover, Berson, Bolick, and Swan (2004) produced a commentary discussing the implications that the conference’s seven conclusions inevitably have in social studies education. In their commentary, van Hover et al. (2004) describe the consequences of these conclusions for social studies educators. Case studies of ubiquitous technology have appeared in social studies classrooms (van Hover, 2004), and Texas Instruments (TI) has already created handheld devices, as well as applications (apps), designed specifically for use in social studies classrooms. The apps vary, but include software that creates electronic customizable electronic flashcards (van Hover, 2004). Palm, Inc. started a program called the Palm Education Pioneers program (PEP), which has given Palm computers to over 100 classrooms across the United States (van Hover, 2004). In Henrico County, Virginia, they have eliminated textbook adoptions and introduced wireless Apple laptops to each student and teacher, and River Hill High School in Clarksville, Maryland gave a ninth grade class wireless Ipaq handhelds. Unfortunately van Hover et al. (2004) does not delve into the failures or successes of such pioneering initiatives. However since this publication other schools across the east coast have also began their own one-to-one computing initiatives that effects social studies education. For example, in 2014-2015 school year ninth and tenth grade students at Central Mountain High School were given MacBook Air computers to use in all of their classes. Chesterfield County Public Schools has given all of their students (over
14,000 students total) Google Chromebooks. Other initiatives are also taking off and are becoming widely popular (Ramsey, 2015).

van Hover et al. (2004) discuss the lack of research and preparedness in implementing such technologies, warning that social studies educators need to work collaboratively in establishing how handheld computers should affect their teaching and learning. Not every teacher intuitively embraces new technology, so it is suggested that proper professional development be offered to allow educators to explore how technology can transform their classroom. They advise that social studies educators are in particular need to identify constructive uses for wireless computing devices within their discipline.

To offset the current lack of research into ubiquitous technologies, the authors advocate conducting ethnographic case studies in actual classrooms producing an in-depth look at how these technological advancements are enhancing actual curricula (van Hover et al., 2004). One of the overall goals for this study is therefore "to foster the development of the skills, knowledge, and participation necessary for students to become good citizens in the democratic society. Beyond this, we must encourage teachers and students to study relationships among new technologies and society" (p.111). They conclude that ubiquitous computing has enormous potential for social studies education, and that teachers will need to transform their traditional approaches to accommodate such technology. In particular, social studies educators should consider how ubiquitous technology could help develop the skills and knowledge required for students to become participating citizens in a democracy.
Rogers et al. (2004) designed an AR lesson called Ambient Wood, where students explored the woodlands. In their study, they provided students with PDAs and used fixed devices, such as a horn placed in the woods, to alert students. They wanted to provide them with contextually relevant digital information at specific times while they explored the woodlands, in the hope that this would provoke them to reflect and discuss with their group members. Rogers et al. (2004) wanted to discover if AR would be more effective if the students initiated the augmentation piece or if the AR piece was better initiated by the environment (i.e., by the GPS). They found that when students initiated the augmentation it promoted collaboration, reflection, and hypothesizing. They concluded that digital augmentation could offer a promising way to enhance education and encourage the dovetailing of exploring and reflecting on the outdoors (Rogers et al., 2004). Although this example is more of a location-based example, it does open up the idea of how students can get more immersed by being engaged and involved in their learning, rather than passive recipients of information.

Augmented Reality and Social Studies Learning

Augmented reality and mobile learning is not a topic often covered by the literature in regards to its use in social studies education (Schrier, 2005). Yet, “Ubiquitous computing has enormous implications for social studies pedagogy, and consequently, teachers will need to transform traditional approaches to curriculum to exercise their full potential” (Hover, Berson, Bolick, & Swan, 2004, p.109). A possible outcome of this research is that students may embrace the power of the handheld
computer while reading, which will also cause teachers to rethink their traditional
teaching methods and consider how handheld computers can help develop the skills and
knowledge required for participation in a democracy (Hover et al., 2004).

Social studies education can and has benefited from mobile learning and more
specifically, augmented reality. Unfortunately although current research in augmented
reality (AR) has emphasized science education similar research oriented toward social
studies education utilizing these techniques is lacking. Despite this drawback, there are a
few researchers who have begun to pioneer the research that marries social studies
education with mobile learning.

Of the various learning scenarios where utilizing augmented reality could enhance
social studies education, two particular contexts, geography and history, have already
started to incorporate AR and mobile technologies. Geography lessons that include maps
have utilized AR (Tan & So, 2001; McGreen & Sánchez, 2005), and history lessons
covering the American Revolution (Schrier, 2005) and European history (Kretchmer et
al., 2002) have also benefitted from AR. Further social studies education contexts remain
unexplored, such as history of the Civil War, World War I, World War II, or field trips to
historical museums, or Washington DC. This research wants to fill in that gap by using
the topics of the civil rights movement and World War II (more specifically Japanese
Internment camps) and show how augmented reality can assist in students gaining a
better understanding while they are reading narratives and prose on them.

There are several problems within social studies education that could be
addressed by augmented reality and other mobile computing technologies. One of the
biggest problems to be addressed is the disconnect between what is being taught in the classroom and reality.

Using Augmented Reality as a Mindtool

Mindtools are defined as “computer tools that have been adapted or created to extend thinking” (Land et al., 2013, p. 214). The work done on mindtools is relevant to this research study as the augmentation that is done on a physical book is a type of mindtool, as it is a tool that is created using technology that aids students to critically think about the reading material. Jonassen (1996) describes mindtools as being “cognitive refection and amplification tools that help learners construct their own representations of a new content domain or visit an old one” (as cited in Land et al., 2013, p. 214). As reading comprehension relies heavily on both the readers prior knowledge, and inference making, augmented reality books could arguably be the mindtool that can assist students in comprehending text. Land and colleagues (2013) describe three important activities in mindtools: (1) amplify - by encouraging deliberate noticing of important pieces, (2) organize - thoughts and processes, and (3) compare, extend, and explain what students know. This research study will use augmented reality to enforce notice on specific material and giving students time to explain within the augmentations themselves, as well as through the concept-mapping activity.
Why Not E-books?

Current research has looked at the efficacy of E-books in education (Adler, Gujar, Harrison, O’Hara, & Sellen, 1998; Coiro, 2003; Longhurst, 2003; Morris, Brush, & Meyers, 2007; O’Hara, & Sellen, 1997). O’Hara and Sellen (1997) found that there are three features that paper-based reading includes that promote the use of static material over online or E-book resources: (1) Paper-based reading allows the reader to have free-text annotation and note taking, which assists the learners to highlight and summarize the text; (2) The support of navigation when one is searching for a specific part of text or cross-referencing different parts of the article; and (3) the ability for the learner to perceive the overall structure of the book for quick-referencing or reading-writing activities (as cited in Chen et al., 2010). Different research studies found that regardless of the advances in the computer technology the learner was equipped with, the readers still preferred reading from paper print rather than technology devices (Morris et al., 2007; O’Hara & Sellen, 1997). These findings are significant to this research study, as it shows that students still prefer a hard copy of a book or paper to read. Regardless of the computer technology, students still want paper-based. Therefore this study uses paper-based reading material and uses technology not to replace the paper-based material, or take away from any of the reasons that students prefer it, but instead supplement by giving students even more flexibility and advantages than they would receive with either E-book or online books.
Augmented Reality Books

Augmented reality books are physical books that have virtual content embedded within the pages. Learners need to use some sort of device in order to view the virtual content, such as an iPad, or a headmount display (Billinghurst & Dünser, 2012). This study uses regular physical books that can be found in their school library. The images already contained inside the book were then augmented using a program called Aurasma. Students used iPads to scan the images in the book to see the superimposed virtual material.

Studies have begun to show the benefits of using augmented reality in static textbooks, as it can become the means to move students to virtual environments (Billinghurst, 2002). Billinghurst (2002) suggests that it is time that educators and researchers work together to discover more ways that augmented reality can be used inside the classroom environment.

Early studies have shown that AR may enhance traditional learning (Billinghurst & Dünser, 2012). The main goal of this research study is to examine how augmented reality can reach full potential in an educational setting, and enhance student learning. Billinghurst and Dünser (2012) lead early investigations in augmented reality and its uses inside the classroom. They believed that augmented reality in the classroom should compliment traditional curriculum materials, not replace it. This research study shows another way that AR can be used inside the classroom-aiding student reading comprehension in social studies classes.
Billinghurst and Dünser's (2012) study takes into account student's reading comprehension and how AR seems to benefit those students who struggle in traditional text-based learning environments. They combined readers with high and low ability and how much they remembered from each format. They found that the groups did not show significant difference in recalling key story points, whether there were AR prompts and material involved or not, but the researchers conceded that these AR books could benefit students who are less able to comprehend text-based learning materials. This research study expands on that to show that not only can augmented reality assist students with low reading comprehension, but it can also help students in comprehending complex social studies concepts.

Augmented reality books hold a few advantages over print books. One of those advantages is the additional interactivity (Billinghurst & Dünser, 2012). Students have more interactions with the physical book due to the need to manipulate the virtual content. For example, this research will have the virtual material ask students questions, which will make them need to be interactive with the iPad to answer the questions, which may engulf them more in the material. Researchers have found that “Tangible user interfaces provide novel and intuitive ways for students to learn and can support playful and collaborative learning” (Billinghurst & Dünser, 2012, p. 57). Ergo the interactivity that the AR material cause is an advantage these books now have prior to their augmentations.

Many studies have used head-mounted displays and computer digital cameras instead of mobile devices (Billinghurst, 2002; Billinghurst, & Dünser, 2012). Other studies have used mobile devices (Chen et al., 2010). This research study uses mobile
devices, so students were able to be more portable with their reading assignment, and did not have to stay in one location. Many students are also already very familiar with iPads, which led to easier usage of the device itself.

Billinghurst and Dünser (2012) believed that augmented reality in the classroom should compliment traditional curriculum materials, not replace it. This research study attempts to demonstrate another way that AR can be used inside the classroom, aiding student learning with already created assignments and curriculum materials.

Researchers are finding that augmenting student paper-based reading has enriched the reader’s experience (Back, Cohen, Gold, Harrison, & Minneman, 2001; Chen et al., 2010; Koike, Sato, & Kobayashi, 2001; Schilit, Golovchinsky, & Price, 1998). Unfortunately the studies that have been done had a few flaws that need to be addressed in this research study; (1) there was a restriction in portability for reading activities due to the technology (for example, with some head mounted displays), (2) the reading only had pre-designed resources, (3) lacked timely, adaptive feedback for readers, and (4) lacked collaboration (Chen et al., 2010). This research focuses on addressing the problems for the first issue by using mobile technology, like iPads, which allow students to move to a comfortable place, and be able to even use the resources outside of school. This research study also addresses the third and fourth issue by giving students adaptive feedback (e.g., when asked a question, students were able to see immediately if they were correct) and students will work together in the activity, giving them a sense of partnership through the activity. The second issue brought up by Chen and colleagues (2010), of pre-designed materials is still an issue that needs to be addressed, but will not be covered in this research study.
In the research study conducted by Chen et al. (2010) they tried to get through some of these issues also by using smart phones (phones that connect to the Internet). Students were given paper-based reading assignment, which had quick response (QR) codes. Each page had an audio piece, a video, still images, and vocabulary embedded in the QR code. Students were then given the option to scan the QR code when they felt stuck. The researchers found that this was not invasive to the learner as they still had everything the paper-resource offered, but also had the virtual information although it wasn’t always physically apparent. They also linked some of the QR codes to Internet resources, which allowed students to go beyond the initial augmentation and use more Internet resources. They found that this system proved practical. They showed that there might be a great potential for augmented reality paper-based reading material to enrich and enhance the learning experience.

Measuring Structural Knowledge

In order to measure structural knowledge, this research study attempts to use concept maps. Taricani and Clariana (2006) define concept maps as “sketches or diagrams that show the relationships among a set of terms by the positions of the terms and by labeled lines and arrows connecting some of the terms” (p. 65). This study suggests the use of concept maps to measure structural knowledge, as the relationships between historical concepts and events are critical to assess what the learner knows.

This research study suggests using open-ended concept maps to assess student structural knowledge on a social studies topic, rather than a pre or post-test. The logic
behind this decision is the understanding that to be knowledgeable in a topic or area, one must have an understanding of interrelationships among important concepts within that domain (Goldsmith, Johnson, & Acton, 1991). Traditional objective test formats (such as multiple-choice or short answer) depend on cued recall and recognition, resulting in student responses that are strongly constrained by the test item. The limitation does not assist in gaining an understanding in student structural knowledge (McClure, Sonak, & Suen, 1999). An alternative assessment that is often used to traditional objective testing is more open assessments, such as reports, presentations, or projects. Although student responses are not as constrained, the quality of responses can be influenced by factors not related to the knowledge, such as vocabulary, speech, etc. Because of this, concept mapping has been suggested as a valid and reliable tool in assessing student structural knowledge (McClure et al., 1999).

The concept maps were initially planned to be evaluated based on expert concept maps. This decision changed based on the data collected (see chapter 4 and 5). The practice of comparing cognitive structures of experts to novices has been used in variety of studies in an attempt to gain understanding of learner structural knowledge (Asino et al., 2012; Goldsmith et al., 1991). Studies have shown that with instruction, novice’s maps eventually become more similar to expert maps (Goldsmith et al., 1991). It was a goal in this study to gain more of an understanding on how scaffolding a book with augmented reality, to assist in student reading comprehension, can strengthen a student’s connections and relationships within a historical concept or event.
Disciplinary Literacy

The expansion of technology in life and the workplace, the internationalization of labor markets, and the changing of workplace demands have increased the importance of literacy (Shanahan & Shanahan, 2008). Increasingly jobs within the United States — even the shrinking pool of blue-collar jobs — often require reading. Jobs in factories, foundries, and mills commonly required no reading, but these jobs are becoming less common. Many other jobs (e.g., law enforcement, practical nursing, trucking) required reading in limited amounts, but now these jobs are not only requiring their workers to read, but to be able to comprehend, evaluate, analyze, and synthesize (Shanahan & Shanahan, 2008).

There are serious concerns and doubts about whether every teacher can be seen as a reading teacher. Often teachers in other disciplines lack any training on teaching how to read to learn content (Brozo, Mooreman, Mayer, & Stewart, 2013; Hall, 2005; Wineburg, 2011). Brozo et al. (2013) are also concerned that a false dichotomy between content area literacy and disciplinary literacy is emerging from a lack of communication. There is now a call for alterative practices grounded in strictly disciplinary reading. This research study tries to answer this call by attempting to find strategies that will increase engagement in reading and learning, to improve literacy skills and abilities, and lead to greater knowledge acquisition (Brozo & Simpson, 2007; Monte-Sano, 2015; Vacca, Vacca, & Mraz, 2010).

According to Brozo et al., (2013), “Disciplinary literacy evolves from the inside out because the text itself and the goals for reading the text dictate the reading processes”
(p. 354). They point out that middle and high school students who struggle with fundamental reading skills and strategies do not possess the skills necessary to learn proficiently.

In order to successfully learn and problem solve, one needs to learn how to be able to analyze, synthesize, and evaluate information from multiple sources of traditional text and other multimodal informational sources. To be an effective reader who is able to analyze, synthesize and evaluate text, one needs to also be able to apply what s/he is reading depending on subject matter. For example, reasoning processes in order to interpret *Macbeth*, and the reasoning processes needed to analyze the causes of the Vietnam War may take different interpretational skills (Goldman, 2012). However, if students cannot master the basic foundations of reading, they will not be able to master the methods and skills needed to be able to efficiently learn any discipline through reading (Brozo et al., 2013; Goldman, 2012; Monte-Sano, 2015; Shanahan & Shanahan, 2008). In order to read for discipline effectively, readers must take an active role, and a critical and questioning stance while reading. Students need to both use general reading skills, but also pay attention to discipline-specific content, reasoning, and knowledge processes (Goldman, 2012).

Moje (2015) argues that there is indeed a problem with how we approach the whole concept of disciplinary literacy. She argues that because of standardized testing, such as the Common Core, a lot of the emphasis has been on teaching strategies, and less on evaluating what the students actually need (Moje, 2015). She breaks down that needed disciplinary teaching practices should include the 4Es: engaging, eliciting/engineering, examining, and evaluating. This is a framework that then influences
the disciplinary practices, which steps include: problem framing, working with data, using varied media to consult and produce multiple text, analyzing, summarizing, and synthesizing findings, examining and evaluating claims, and communicating claims.

From this perspective the problem isn’t in the standard or good curricula, but that disciplinary practice is action oriented, and should revolve around humans trying to solve problems or address questions of curiosity, passion, or urgency.

Hall (2005) argues that students of all abilities can improve their reading comprehension of content area texts if they are provided with reading instruction in the content areas. In this research study, we focus on the discipline of history, and in history, Hall (2005) explains that students may read texts for purposes different than the ones in science. Here students may often need to identify historical biases and to separate facts from persuasive arguments.

This gives teachers two tasks. They need to be both proficient in their subject matter as well as understand how to help their students develop the sophisticated skills needed to read texts in ways that are specific to their content area(s). This is where the major problem lies, as most teachers are not trained to do this. If teachers are not given the opportunity or training to consider and support students in the wide range of reading skills students must apply to texts and the purposes they must read for, then they may not understand important differences between subject matter (Hall, 2005; Monto-Sano, 2010).

Goldman (2012) explains that “research related to disciplinary literacies and the use of online resources is just emerging” (p. 90). This research study attempts to close some of the gaps in the research by using online resources in the augmentations in order
to discover ways that these resources may be able to assist students in using analytical and critical thinking when trying to learn discipline specific content.

Goldman (2012) argues that many “students do not automatically make the transition from learning to read to reading to learn” (p. 91). A goal of this study is to help students in that transition. Middle grades and high school teachers’ primary responsibility has been to teach the content, and they tend to de-emphasize the literacy practices central to comprehending the content. This ends up increasing the struggles of students who may not have learned to read adequately in elementary school (Goldman, 2012).

Goldman (2012) identifies five characteristics that make a successful reader; all five involve active engagement. All five characteristics are taken into consideration when analyzing the data collected for this research study.

1. Those who are successfully reading to learn monitor their comprehension and use a range of strategies when they realize they do not understand what they are reading.

2. Successful readers are able to explain concepts in the text and relate different concepts within a text to each other and to relevant knowledge they have already acquired.

3. They often generate self-explanations during reading, ask questions that probe the connections among parts of the text, or seek explanations.

4. They use cues to the logical organization of a text to guide their comprehension.

5. They rely on multiple types of knowledge (for example, knowledge of words, concepts, sentence structures, text structures, genres) as they try to
interpret print. By contrast, students who are weak at comprehension tend to restate or paraphrase texts, substituting synonyms or reordering the words, rather than explaining. Any connections these readers make or questions they ask tend to be superficial (p. 93).

Students often see history as what happened, as a given set of fixed facts rather than as interpretation (Monte-Sano, 2011). Opposing viewpoints tend to be labeled as “right” or “wrong”. This causes a problem when students are attempting to comprehend when reading in history class. Students tend to focus on the literal meaning of historical documents and lack reading strategies that might promote interpretive work (Afflerbach & VanSledright, 2001; Monte-Sano, 2011; Wineburg, 2001). Nokes (2013) suggests that by reading historical fictions students will be able to get a better sense of contextualization (p. 120), “the process of conceptualizing the physical, social, and interpersonal context of a historical event” (p. 124). Nokes (2013) argues that by encouraging historical empathy students become deeply engaged with the text, and become active in the learning process and are motivated as both reader and thinker. By encouraging students to deeply engage in the learning process, we may help them understand the subject matter (in this case, history) better.

According to Monte-Sano (2011) “attention to students’ evidentiary reasoning and conceptions of history is essential to advancing their understanding of history and their disciplinary thinking” (p. 261). This study attempts to capture some of the evidence in student reasoning while creating their concept maps, in order to understand their disciplinary thinking. We believe that this will help us to promote historical thinking, and
help shift students’ epistemic beliefs, opening the door to reasoning with evidence (Monte-Sano, 2011).

According to the International Reading Association (IRA), adolescents need to question themselves about what they read. They need to recognize how a text is organized, and they need to judge their own understanding, and evaluate the other’s perspectives and ideas. Monte-Sano (2015) explains that reports on the state of adolescent literacy are very concerning, as very few adolescents demonstrate these skills (p. 213). An overall goal for this study is to shine a light for the need for content teachers to integrate reading and writing skills that are particular to their subject areas.
Chapter 3
Methodology

Research Design

This study uses a qualitative methodology (Creswell, 2012) to explore the research questions. Specifically, this study uses a comparative case study design as described by Stake (2013) and Goodrick (2014). Stake (2013) describes that when studying multiple cases at a time, each case should be seen as different while at the same time having something in common. This allowed the researchers to be able to analyze each case alone as well as compare them to each other. This qualitative method was selected for this study because it focuses on two different classes each with different levels of ability that still have the same teacher (their common feature). The case study approach allows us to look at several cases -- or in this case several groups of students -- to investigate a phenomenon within a particular population (Glesne, 2011; Stake, 2013).

As this study is a qualitative design, it involves rich descriptions (Creswell, 2012) of each case, collected through audio recordings and participatory observational field notes. Audio recordings were transcribed and analyzed to determine the nature of student discourse both when scaffolds are present in assigned reading and when they are not, and to investigate signs of reading comprehension. These transcriptions were analyzed and coded for the four major activities that Palincsar and Brown (1984) identify as taking place during reading: summarizing, questioning, clarifying, and predicting.
This study attempted to use quantitative measures by analyzing pre and post concept maps. This study used concept maps over pre and post tests, because we sought to understand student cognitive connections, and knowledge structure, not necessarily student recall. Prior to reading the assigned history book, the groups completed a concept map on their knowledge about a historical topic that was featured in their reading. These concept maps were open-ended, meaning that students were able to use any term they could come up with in their map, rather than having a bank of terms to pick from. The critical task is to recall as opposed to recognizing terms from a list (a closed concept map) (Clariana, 2010). It should be noted that it is more difficult for both instructor and computer to score open-ended concept maps (Clariana, 2010). However, due to the possibility of students stumbling upon a correct answer, or having clues about what to look for in the text, open-ended concept maps were selected. The maps were initially to be scored by comparing their similarity to an expert concept map constructed prior to data collection. After students completed the reading activity they completed a post-concept map, which were originally to be assessed by a gain-score analysis. Because of some of the limitations of this study, as well as some of the qualitative data collected through field notes, the way the maps were analyzed had to change. Instead of doing a full gain score analysis, some qualitative data was collected through participatory field notes and student discourse and a detailed description is given for each group in regards to their map creation (see Chapter 4 and 5).

Five cases were then selected for further in-depth analysis. These cases were selected based on their completeness of data collected, audio quality, and those cases that are most representative of the general participant population.
Research Setting

This research study took place in a small, public, rural county in the state of Virginia during the spring semester, 2015. Data were collected for over a two week period in mid to late March 2015. In December 2013, the county had a total of 2201 students in grades K-12. Of those 2201 students, the county has 259 students identified as being students with disabilities. At the single middle school in which this study took place, 71 out of 481 students were identified as being students with disabilities, which equals 13.5 percent of the population, which comes in a little higher than the whole county at 11.7 percent. In addition, 22 percent of the overall population in this county is African American – and 30 percent of those identified as a student with disabilities are African American. The ratio is higher for African Americans students having disabilities than Caucasians, who make up 73 percent of the overall population but only 60 percent of the population of students with disabilities. The percent of youth with Individual Education Plans (IEPs) graduating from high school with a regular diploma is only 36.8. Only 65.2 percent of the students with disabilities rate proficiently for English and reading, meaning nearly 35 percent of those students never get to a proficient level of reading. Unfortunately, according to the statistics presented by the Virginia Department of Education, 3.25 percent of students with disabilities between the grades seven through twelve drop out of school. Only 25 percent of students with disabilities enroll in higher education within one year of leaving high school.

This east coast middle school has 25 percent of the students eligible for free lunch and another eight percent eligible for reduced lunch. 75% of the population at this middle
school is white, 22 percent are African American, two percent are American Indian, and one percent is Asian. This county does not have any other nationalities recorded. Less than half of the parents of the school county’s students have college degrees (Point2homes, n.d.).

This study took place in the only middle school in this county in Virginia, focusing on two seventh grade social studies classes. The students in these classes are mixed in abilities. According to the classroom teacher, some of the students are very low level, and a few students are identified as being gifted and are involved in the gifted program provided by the school. The majority of the students in these two classes do not fall into either category.

In the seventh grade, students learn about the second half of United States history (1877–current events) in their social studies classes. The two books that were selected for this research are on topics that are covered throughout the school year in the curriculum.

This classroom was selected because of my current professional relationship with the school. I previously taught social studies in both the seventh and eighth grades in this school, and am currently the Instructional Technology Resource Specialist. My professional relationship with both the social studies department, as well as this teacher in particular, made it an ideal setting for this research to be conducted.

Only one teacher, who will be referred to by the pseudonym Mrs. Bennet, uses this particular classroom. This teacher’s first history class begins at 8:40AM, lasts for 65 minutes, and contains 24 students. The following social studies class Mrs. Bennet teaches is a collaborative class (a class with both students with disabilities, students identified as gifted, and students who have not been identified as either). That class has 13 students
with Individualized Educational Plans (IEPs). To try and maintain some homogeny within the pool of participants, data were not collected for this class. However, future studies may benefit from focusing more on students with disabilities, and how AR books may scaffold their learning in a way to assist them within the collaborative classroom.

After the first two classes, Mrs. Bennet has 45 minutes in which she has planning time, and 45 minutes of duty time (usually monitoring hallways, or the lunchroom). After lunch Mrs. Bennet has her third history class of the day, which contains 18 students. Mrs. Bennet teaches a fourth class, which is an English class, which was not involved in this study.

The classroom contains desks that are sometimes put into rows and sometimes put together for students to collaborate more easily with one another. During this activity, students receiving the scaffolded version of the research activity were assigned an iPad mini. The iPads belong to the school and were granted to seventh-grade special education teacher, Mrs. Lucas, after she wrote a study to the school counties’ Director for Finance detailing how she would use the iPads to enhance her students’ learning. Mrs. Lucas graciously allowed Mrs. Bennet and the researchers to use the iPad minis for this assignment. Since this research project has taken place, the school has purchased 30 iPad minis that teachers are able to sign out for their classrooms to use.

Beyond these iPads, Mrs. Bennet’s classroom also holds four Personal Computers (PCs) and a SMARTBoard (an interactive whiteboard), which the teacher uses regularly. Three of the PCs are arranged to form a student workstation in the back in the room. In another corner of the room, the teachers designed a space to hold resources for the students, including many history books and workbooks. On the opposite side of the room
where the teacher’s desk and PC workstation are located, there is a SMARTBoard. This space was selected because it is the natural setting in which students participate in their history instruction and practice.

Participants

Mrs. Bennet’s classes were selected based on my relationship with this particular middle school, as I was a previous teacher in the school, and I worked closely with Mrs. Bennet in the past as a social studies teacher. I am currently the Instructional Technology Resource Specialist for the entire school county, which makes it natural for me to come in and work as a participant observer with the students with educational technology. Most of the students have already worked with me on some project for one or more of their classes in the past.

Mrs. Bennet describes her first period social studies class as being very mixed abilities, academically. She states that the group has shown themselves to being very creative, but because of their tendency to get off task when they do projects, the teacher usually reverts back to the traditional history classroom, of lecture and note taking. Due to the number of consents received, as well as the completeness of data collected, four students’ data was fully analyzed, all females. This class did not receive AR embedded in their books.

The second social studies class included 18 students, with one student with an IEP; however the IEP does not dictate the student needed any accommodations for his or her social studies class. This class had eight students that were identified as gifted. Due to
the number of consents received, as well as the completeness of data collected six students’ data was fully analyzed, all females. This class did receive AR embedded in their books.

**Materials and Scaffolds**

This study used Aurasma, a free application that is available on both Android and Apple mobile devices. Aurasma enables the user to take an image and embed information in it (Aurasma, 2015). The application uses image and pattern recognition to blend the real world with rich interactive content such as videos and animations. For example, the user can upload a picture of George Washington that, when scanned by a mobile device, will trigger a website to open, a 3D image to pop up, or an animated character to start talking and engaging the user.

The participants in this study used iPad Minis, a device in which the school has purchased for students to use. The iPad Mini includes a camera and a screen, allowing for the implementation of augmented material. iPad Minis are mobile devices that work on wireless networks (Apple, 2014). The application Aurasma requires Internet connectivity, and the students were able to use Aurasma via the school’s wireless network (Aurasma, 2015).

The augmented reality segments, which scaffold the reading material for the learners were partially designed based on the research conducted by Palincsar and Brown (1984) (see Table 2.2) on reading comprehension. Palincsar and Brown (1984) have outlined six functions that good reading activities will give the reader when trying to
comprehend the material. The following table describes the six functions described by Palincsar and Brown (1984) and how they were implemented in this study (see Table 3.1).

Table 3.1 *Reading Activities that Promote Comprehension*

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Implementation in Design</th>
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<tbody>
<tr>
<td>Understanding the purposes of reading, both explicit and implicit</td>
<td>The videos played in the cover of each book not only gave students prior knowledge, but were able to give them an idea of why reading this book, and books on these historical events is important (this was done using edpuzzle because you can add in interactive questions, and comments, and monitor student engagement).</td>
</tr>
<tr>
<td>Activating relevant background knowledge</td>
<td>When a student started to read the AR book they were prompted first to scan the cover of the book with their iPad. The application, Aurasma, launched the students into a video to give them some background information on the topic before they read the book (this was done using edpuzzle because you can add in interactive questions, and comments, and monitor student engagement).</td>
</tr>
<tr>
<td>Allocating attentions that concentration can be focused on the major content at the expense of trivia</td>
<td>The videos included on the front cover prompted the students to answer embedded questions to focus their attention on important content (this was done using edpuzzle because you can add in interactive questions, and comments, and monitor student engagement). As students were reading the book they scanned pictures on each page, which also focused their attention on major content.</td>
</tr>
<tr>
<td>Critical evaluation of content for internal consistency, and compatibility with prior knowledge and common sense</td>
<td>Some augmentations allowed students to evaluate the material based on what they already know (This was done using Google Forms, as it allowed us to assess student responses, to verify that the activity was being completed).</td>
</tr>
<tr>
<td>Monitoring ongoing activities to see if comprehension is occurring, by engaging in such activities as periodic review</td>
<td>Some augmentations allowed students to monitor ongoing activities (This was done using screenchomp, a screencasting tool, in which students explained via screencasting what they</td>
</tr>
</tbody>
</table>


and self-interrogation; have already learned, and also done through Google Forms, so we could assess the response).

| Drawing and testing inferences of many kinds, including interpretations, predictions, and conclusions | At the end of the book, they were given time to draw and test interpretations and conclusions (This was done using Google Forms, as it allowed us to assess student responses, to verify that the activity was being completed). |

Each of the two books selected for this activity were embedded with augmented reality to assist students in comprehending the reading material.

Based on scaffolding research, the design of the augmentations included: question prompts, monitoring, corrective feedback, and needed prior knowledge (see table 2.2 in chapter 2). This research design included all of these scaffolds in order to assist students in reading comprehension (Chen et al., 2010; Goldman, 2012; Palincsar and Brown, 1984). The following strategies were used based on instructional and technical design research conducted by Quintana et al. (2004) for science inquiry scaffolds. Although this study is not in the domain of scientific inquiry, four of the guidelines specified in Quintana et al. (2004) were adapted for use in this study:

Table 3.2 Framework Based on AR, Reading Comprehension, and Technological Scaffolds

<table>
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<tr>
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<tbody>
<tr>
<td>Use representations and language that bridge learners’ understanding (Prior Knowledge)</td>
<td>Palincsar and Brown (1984) emphasize connecting prior knowledge to what they are currently reading</td>
<td>Each scaffold includes either a picture or video that gives more information on the topic.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Difficult words within the text</td>
</tr>
</tbody>
</table>
One of the two books that were augmented for this study is *Birmingham, 1963* by Carole Boston Weatherford. This book was selected for the poetic form in which it was written; students need to be able to comprehend the meanings behind certain phrases in order to comprehend the historical events within the poem. This, however, was difficult if students have a severe lack of prior knowledge on the Civil Rights Movement. It was also selected due to the historical imagery already printed in the book (see Figure 3.1). Most of the images do not give great detail about the specific text next to it but they are real images from the events in Birmingham in 1963. With AR, this book can tie the
pictures more closely to the words and give them more meaning, which in turn might allow students to infer more information from the overall text.

The second book selected was *Home of the Brave* by Allen Say. This book was selected due to the nature of the narrative. *Home of the Brave* is written in dreamlike sequences where a man symbolically confronts the trauma he faced in a Japanese internment camp during World War II (see Figure 3.2). This book tries to challenge readers to look beyond just the facts and statistics to the emotional impact. Unfortunately, if students lack the facts and statistics, the emotional impact may also be lost. The scaffolds created by augmented reality try to tie in the connection of facts to the dreamlike sequences, so students may follow the story better, and learn more from the narrative.
Figure 3.1. *Images from Birmingham, 1963*

Figure 3.2. *Images from Home of the Brave*
Procedure

In the fall of 2014 I met with Mrs. Bennet and discussed the various topics that would be taught in her social studies class during the 2014-2015 school year and how we could include narrative books from those events that students may normally have difficulty in comprehending. We chose *Birmingham, 1963* by Carole Boston Weatherford and *Home of the Brave* by Allen Say, because these texts go over topics that students learn in social studies class but are generally not well canvassed in the classroom. Mrs. Bennet explained that the students generally struggle with these topics (the Civil Rights Movement and Japanese internment camps during World War II). In particular, these books are harder for students to comprehend, because it uses language that infers or implies the struggles of the times instead of clearly stating what was happening during that time period.

The following procedures took place for participants who did not receive AR books: (1) students were put into groups of two and asked to create a concept map on a particular historical event or concept (based on the specified book); (2) One duo at a time received a copy of one of the three books. The group read the book out loud together; (3) Once the book was read, students created a post-concept map about the particular historical event or concept (based on the specified book); (4) Student’s concept maps were collected and analyzed to determine student growth in the historical concept or event; (5) Students repeated the process the following days with the second book.

The following procedures were followed for participants who received AR books: (1) students were put into groups of two and asked to create a concept map on a particular
historical event or concept (based on the specified book); (2) One duo at a time received a copy of one of the three AR books; (3) students were trained on how Aurasma works using an example that was not from a book they were reading as a demonstration; (4) The pairs read the AR book out loud together. (5) After the book was read aloud, the students worked together to create a post-concept map about the particular historical event or concept (based on the specified book); (6) Student’s concept maps were collected; (7) students repeated the process the remaining days with the second book.

**Data collection and Analysis**

Students were required to have parental consent to participate in this study. The parental consent was sent home two weeks before data collection. Students were also required to give written consent and verbal assent that they were willing to be part of the study. The data were collected for this study using qualitative ethnographical methods, such as participatory field notes, and transcribing and coding audio recordings. All verbal interactions between the pairs (both AR and non-AR groups) were recorded. The researcher used field notes from participant observations, and audio recording in an attempt to answer the first research question. The audio was then transcribed and analyzed based on a coding scheme for the four major activities students should be involved in while reading outlined by Palincsar and Brown (1984): questioning, clarifying, summarizing, and predicting to determine if reading comprehension strategies were used when augmentations were and were not present.
This study also attempted to collect data via pre and post concept maps. These maps were analyzed for changes in understanding of the historical concepts and events that students read about during the exercise. These maps were initially set to be analyzed using a quantitative gain score analysis, but were instead were analyzed qualitatively (see chapter 4 and 5). After all the concept maps were complete and participant observations are done, I analyzed each case separately before comparing each case to one another to determine the efficacy of the provided scaffolding on student’s reading strategies.

**Trustworthiness**

Qualitative studies are not meant to make generalizations or judge whether or not a theory is true or accurate. Due to these views, the concept of credibility or trustworthiness is taken seriously in this study. Creswell (2012) describes how a qualitative research study can still prove that the results are valid and reliable:

1. Prolonged engagement and persistent observations to develop trust, learn the culture, and check hunches. This study met this procedure as I worked with these students on other occasions. Being the school’s Instructional Technology Resource Specialist, the teacher and students are already familiar with me, as I have already made informal observations and made hypothesis based on what I have seen the last few months.

2. Triangulation – the use of multiple data-collection methods, sources, investigators, and theoretical perspectives. This study answers this criteria by using observations, field notes, and surveys, as well as checking the data collected with the classroom teacher’s knowledge and viewing the data collected in the a variety of
perspectives. Although this research relied heavily on qualitative data, it also included an element of quantitative data found in the pre and post concept maps.

3. Peer review and debriefing – external reflection and input. This was answered by a variety of people, including the classroom teachers and my advisor at The Pennsylvania State University.

4. Negative case analysis – some acknowledgement that there are other cases and disconfirming evidence to refine the hypothesis. I acknowledge that these case studies in this study were done with a very specific population under very specific conditions. I also recognize that, the analysis and conclusions may lean one way in this circumstance but could have different results in a different population such as in “Augmenting paper-based reading activity with direct access to digital materials and scaffolded questioning” (Chen, Teng, & Lee, 2011).

5. Clarification of researcher bias – Due to the my relationship with the school, it is important for me to acknowledge that my pre-existing relationship with the teachers, students, administration, and the school in general may have affected some subjectivity. A different researcher with less of a relationship with these students may yield different results.

6. Member checking – sharing data collected, such as interview transcripts and analytical thoughts. This study addressed this criterion by sharing information with my advisor at The Pennsylvania State University.

7. Rich, thick description – This study covered this criteria by using rich narratives that allow readers to enter the research context.
8. Finally, the last criteria outlined by Creswell (2012) is external audit – by allowing an outside person to examine the research process and product by auditing field notes, research journals, and coding schemes. This study addressed this criterion through my advisor and dissertation committee at The Pennsylvania State University and by passing the rigorous standards set by the Internet Review Board (IRB) for human participant research at The Pennsylvania State University.

By following the criteria that was laid out to increase trustworthiness of the qualitative side of this study, it is hoped that the findings and conclusion of this study are found to be valid.

Confidentiality and Ethical Considerations

At the beginning of this study, I entered the classroom and explained to each class that I am not only an Instructional Technology Resource Specialist for their county, but that I am also a researcher for The Pennsylvania State University. I also explained to the students what we would be doing in the study and how I would maintain their confidentiality. No real names were used in this study. Each participant, including the teacher, was assigned a pseudonym throughout data collection, organization, storage, and analysis. No identifying information is displayed in this research report. Any information regarding special or gifted needs is also being held confidential and was not be included in this study to the extent agreed upon by the school’s Superintendent, Principal, Teachers, and The Pennsylvania State University’s Institutional Review Board (IRB). This study was conducted under the approval of The Pennsylvania State University’s
IRB. Data were collected and organized using Microsoft Excel, and student information including students’ actual names, corresponding pseudonym, parent consent, and child assent were stored on the spreadsheet. The spreadsheet followed IRB criteria and was stored in a password protected file on an external hard-drive (also password protected) and kept in a locked room. Student’s identifying information was kept separate from data collected (audio recordings, and concept maps), which was kept on a separate hard-drive that was also password protected, and kept in a lock draw in a locked room.
Chapter 4

Data Collection and Analysis

This study explored how augmented reality books helped students with reading comprehension when reading historical fiction. The results of this study are presented according to each research question and combine and compare the results from each of the five case studies.

Data collection took place for this comparative case study in late March, 2015. During the students’ regular social studies class period, the participants were assigned a partner and began to work in stations. The reading of the AR/historical fiction book was one of the three stations they participated in. The other two stations were completely designed by the teacher. Those lessons did not include any information on the Civil Rights Movement or Japanese internment camps, in order for it not to affect the data collected. According to Goodrick (2014), comparative case studies usually include some combination of fieldwork visits, observations, interviews and document analysis for data collection. Over five days, the participants completed two pre-concept maps, read both books, and completed two post-concept maps. I used field notes during participant observations, document analysis (the pre and post concept maps), and discourse analysis.

Overview of the Cases
This section presents a general overview of each of the 5 cases analyzed for this study. Each case is described briefly in terms of the general approaches taken for their pre-concept maps, reading time, and post-concept map activities. The sections that follow in this chapter provide more detailed analyses for each of these activities according to the two primary research questions. This study initially collected data from 10 groups (the group numbers go up to 14, because originally there were groups who wanted to participate, but then did not provide parental consent), but because of incomplete data I only fully analyzed five cases. Table 4.1 displays the breakdown of the groups analyzed, and their pseudonyms:

Table 4.1: Fully Participating Groups

<table>
<thead>
<tr>
<th>Group Number</th>
<th>AR/Non-AR</th>
<th>Pseudonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Non-AR</td>
<td>Person 1: Elizabeth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Person 2: Harriet</td>
</tr>
<tr>
<td>14</td>
<td>Non-AR</td>
<td>Person 1: Augusta</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Person 2: Jane</td>
</tr>
<tr>
<td>4</td>
<td>AR</td>
<td>Person 1: Anne</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Person 2: Emma</td>
</tr>
<tr>
<td>5</td>
<td>AR</td>
<td>Person 1: Henrietta</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Person 2: Penelope</td>
</tr>
<tr>
<td>8</td>
<td>AR</td>
<td>Person 1: Marianne</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Person 2: Charlotte</td>
</tr>
</tbody>
</table>
Group 11: Elizabeth and Harriet (Non-AR)

Elizabeth and Harriet are two seventh grade girls who took this assignment very seriously. However, like a few of the other groups they were confused by the idea of concept maps. They worked very well together overall. They took turns while constructing the post-concept map and together they tried very hard on their concept maps to try to overcome the confusion. Looking at their discourse, the confusion about the topic showed more of a problem with vocabulary instead of the actual concept itself. The group was more confused on the book “Birmingham”. Even though the group was told to create a map strictly on the ‘Civil Rights Movement’, they could not get past the point that they did not know what “Birmingham” was. The following is part of their discourse when creating their pre-map for Birmingham, 1963:

Elizabeth: Honestly, I don’t know anything about Birmingham, do you?

Harriet: No.


Harriet: Just they…it’s a country?

Elizabeth: (Laughs) It’s not a country. I don’t know.

Harriet: It’s a state? It’s a state like…

Elizabeth: (Laughs) I don’t know, anyway…okay…

This left Group 11’s pre-concept map completely empty (see image 4.1). This group read their book out loud during the reading activity, but Harriet did not take any
part of the reading, only Elizabeth read the book out loud. There was no conversation
during the reading activity, besides Elizabeth reading the exact text.

While creating the post-map the two worked very well together, but it was clear
there was confusion about what happened in the book.

Harriet: Yeah it was a city.

Elizabeth: Yeah

Harriet: They were treated very bad.

Elizabeth: Yeah Birmingham was a sitting (setting?), and
the blacks were treated really bad. Two people died during
the bombs, and two girls.

Harriet: Didn’t two girls diet at church?

Elizabeth: Four girls died.

Interestingly, the girls seemed to miss that the narrator of the story was fictional. They
ended up including facts about her on their post-concept map (Please keep in mind when
reading this part of the transcript, that this is part of the fiction of the story – the 10 year
old girl was the narrator of the poem, and it was not based on a real person):

Harriet: Good girl that was ten.

Elizabeth: Yeah the girl that was ten…

Harriet: She never got her birthday cause of it.

Elizabeth: Yeah, what was her name?

Harriet: Doesn’t say.

Elizabeth: It was on…one girl’s birthday. It was on a little
girl’s tenth birthday.
The final post-map does reflect some overall ideas for the Civil Rights movement, but some of the nodes were basic, like Birmingham being a city. Although Birmingham being a city is an important fact to understanding the events in *Birmingham, 1963*, no other group felt the need to add such a basic fact to their maps. The fact that their node gain went from zero to eight might reflect more of an absence of basic prior knowledge that other groups did not feel important enough to include in either their pre or post maps. An important distinguishing feature of Elizabeth and Harriet is that during their reading activity, it was completely one sided -- only Elizabeth read the book, and there was no other discussion about the book until they began to work on their concept maps. It was evident that there was a clear lack of historical empathy and some misconceptions and disconnect about what happened in the book.

**Group 14: Augusta and Jane (Non-AR)**

Augusta and Jane were very different from Elizabeth and Harriet, although they were in the same class. Augusta and Jane had more evident background knowledge and centered their map around the Civil Rights Movement. They spent a great deal of time thinking of everything they could put on the map. Their original map had three main sections: Martin Luther King Jr., Rosa Parks, and the Ku Klux Klan. Each of those separated into many other nodes, showing that they already had a good base of knowledge about the civil rights movement. During the reading activity Augusta and Jane took turns reading, but they did not have any other conversation outside of reading the book, showing a lack of collaborative discourse when they read.
During the post-map activity, the girls altered their map around the book itself, with less about the Civil Rights Movement. The girls had the exact same number of nodes, however they removed people and events from their original map, such as Rosa Parks and the Bus Boycott. It was replaced by a node on the book, *Birmingham, 1963* in particular. They also talk about Martin Luther King Jr. but only focused on his “I have a Dream” speech, and nothing about his assassination, which was included on the first map. Instead their Civil Rights Movement post-map centered around the Ku Klux Klan and events during 1963.

An important part of their discourse during the post-map activity was, like group 11, they seemed to still be confused about certain facts. For example when reading *Home of the Brave* the following conversation took place:

Jane: Which ones came to like…

Augusta: Which ones came?

Jane: Ohh…what do you mean?

Augusta: Like you mean if it was Japanese people or American?

Jane: Yeah.

Augusta: Uh…I don’t know. I am guessing that they’re Japanese.

Jane: Okay.

Augusta: You can write the Japanese had prisoners.

After reading *Home of the Brave*, the girls were confused about whether the book was discussing the internment of Japanese or Americans (and in reality it was Japanese-Americans). They became even more confused when they said that the Japanese themselves were keeping prisoners. Interestingly, I asked this group after the activity
which book they preferred, *Birmingham, 1963* or *Home of the Brave*, and they both agreed *Home of the Brave*.

**Group 4: Anne and Emma (AR)**

Anne and Emma were one of the first groups to work on the augmented reality embedded books. They were self-directed learners, and did not require help to examine the AR scaffolds embedded in the books. Even though they were well-behaved and self-directed, these girls appeared very apathetic about the overall assignment and objectives. Even though they were not enthusiastic about the task, they did complete the task efficiently. They took turns reading the book, and Emma was assigned the iPad mini to scan the images.

Emma and Anne had heard of Japanese internment camps prior to reading *Home of the Brave*, but it was clear there were some misconceptions. For example:

Anne: Mmm…opposite of camps in Germany.

Emma: Nobody died.

Anne: Okay.

Emma: It was for good, and not bad.

The girls decided that the camps were a good thing, simply because it did not result in mass deaths, like the German Concentration camps of World War II.

During the reading activity the girls spoke often, as shown in the following excerpt:

Emma: Why do you think they wanted to do that?
Anne: Because they were afraid of the Japanese in America, they were sent there to spy on them and try to hurt them like they did in Pearl Harbor…conspire with Japan to try and plan an attack on them through the military people that they had on American military.

Emma: America put them in these camps so they could prevent them from doing that.

The misconceptions that were obvious in the discourse while Emma and Anne worked on the pre-concept map started to clear up by the time they began the post-concept maps:

Emma: Okay, they were bad to the Japanese.
Anne: Yeah. Okay, so…so there were letters sent to President Roosevelt saying that…suggested imprisoning Japanese-Americans as hostages for safety.

These girls not only were able to differentiate what was really happening in the camps, but also were able to distinguish that this was happening to Japanese-Americans and Hawaiians. Neither of the two groups with non-AR books was able to distinguish this difference.

**Group 5: Penelope and Henrietta (AR)**

Penelope and Henrietta were bothered by not knowing anything about the subject when they began their pre-concept maps. They were caught a few times trying to peak at
the books to draw information from them while building their pre-concept maps. They had to be corrected more than once not to do this. This group also had a few technology glitches, trying to get the AR to work.

During the reading activity embedded with the AR, the girls would start debating. They showed evidence of trying to interpret and comprehend what they were reading:

Henrietta: What can segregation do to black students?
Penelope: This is really affecting black students…
Henrietta:…I’d say…
Penelope: Because it would probably provide better education than whites.
Henrietta: Really? They weren’t treated equal, even though they say they were separate but equal, it really wasn’t equal.
Penelope: …I didn’t know.

This group had interesting conversations that continued after the book had concluded, discussing what they had taken out of it.

When they started the pre-map on Japanese internment camps, the girls constantly were trying to look at the book. They were reminded a few times that it was okay if they did not know anything about them, but this did not settle with them well:

Penelope: So…we can put…probably were like concentration camps. Uh…I don’t know what else to write…
Henrietta: Mmm…well…is it…
Penelope: Judging by the cover we can say it was a concentration camp, but for Japanese. We learned about it from Jewish people…but it was Japanese, but I don’t know how this relates to Japanese people…

Because of their lack of prior knowledge, there was a large node count difference between their pre and post concept maps. All the facts in the post map were accurate, but it makes it harder to distinguish how much of it was due to the book itself or because of the AR scaffolds.

The other important piece of information is that this group did not complete their book by the end of the class. Although they were told that their next teacher had already been contacted and that they would be given a written pass when completed, it created some concern in this group about completing the activity. This group may have included more on their post-map if they were not in a hurry to finish and go to their next class.

**Group 8: Marianne and Charlotte (AR)**

Marianne and Charlotte are very good students in general, and needed very little help or prompting to complete their task. They seemed to enjoy themselves, and were often laughing and talking to one another about the subject. They were effective partners who took turns and read enthusiastically. They also worked hard on both pre and post concept maps.

While creating the pre-map on *Home of the Brave*, they started singing a song:
Marianne: All I can think of is Cesar Chavez when he did boycotts on lettuce or something like that (starts singing)
Cesar Chavez migrant worker helped to set a labor union,
led a boycott on grapes and lettuce, fought for workers rights.
Charlotte: (Laughs)
Marianne: It was great. Lettuce.
Marianne and Charlotte then tied this movement in with the Civil Rights Movement and boycotts. This was removed from their post-map, though.

These girls also used reading comprehension and collaboration strategies while reading:

Marianne: What were they planning?
Charlotte: Um…two…does it mean just to…freedom is that what it’s trying to say?
Marianne: ...(starts reading) They were making big plans (stops reading) during the mass meeting at church…So…those plans…to be treated rightfully.
Charlotte: Rightfully.
Marianne: Rightfully and respectfully.

This group’s pre and post-concept maps were difficult to interpret for evidence of growth. Originally their pre-map and post-maps had exactly four nodes each. When I noticed this, we asked them about it, and they said that they purposely did not include the old nodes, because they thought we cared more about what new things they learned, and not about what they already knew. It was then explained to them that we wanted to see
the growth and connections, but not to get rid of the original nodes, unless they no longer saw them as relevant for their new map.

**Research Question One**

The first research question was: *What kinds of comprehension strategies are evidenced in the discourse between pairs of students while reading historical fiction?*

1. *Are there different qualitative patterns of the discourse between groups of students who receive embedded, augmented reality scaffolds of reading comprehension strategies and those who did not receive the scaffolds?*

To address the first research questions, the students were audio recorded while they were making both maps, as well as when they were reading the book. Student discourse was then transcribed, and the transcripts were coded for evidence of clarifying statements, predicting statements, questioning statements, and summarizing statements (Palincsar & Brown, 1984). The codes were then added up and averaged per activity (the activities included the construction of the pre-concept map, reading the book, and the construction of the post-concept map). The analyses showed that students demonstrated questioning, clarifying, summarizing, and occasionally predicting while reading the historical fiction *if* augmented reality scaffolds were embedded in the novel. However whenever there were no AR scaffolds embedded, the groups showed no clarifying, questioning, summarizing or predicting statements during the reading activity. The first part of research question one is easy to visualize (See Table 4.1-4.4).
By scaffolding students to use clarifying, questioning, summarizing, and predicting statements, they are supported to read for meaning (Goldman, 2012; Palincsar & Brown, 1986, p. 772). Palincsar and Brown (1984) examined the different elements needed in order to help students read for meaning. They describe clarifying statements as explaining the meaning behind the words or context rather than reading straight through. Summary is seen as an effective strategy because it allows students to integrate what they know with the text, and help connect paragraph to paragraph, page to page, as well as connect different and difficult topics (Palincsar & Brown, 1986). Questioning statements allowed students to ask each other questions and frame good questions to help them understand what was happening in the story and how it related to the topic. Finally, predicting, which was the least identified category in this data set, enables students to use what they currently know and predict will happen in the future, pushing students to use critical thinking skills and question what they already know (Palincsar & Brown, 1986, p. 772).

Tables 4.2 and 4.3 show how many times students made clarifying, summary, questioning, or predicting statements while creating their concept maps, while they were reading Birmingham, 1963, and again when they created their post concept map.
Table 4.2: Reading activity comprehension talk for Elizabeth and Harriet and Augusta and Jane (Non-AR) for the book Birmingham, 1963

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.3: Reading activity comprehension talk for Anne & Emma, Henrietta & Penelope, Marianne & Charlotte (AR) for the book Birmingham, 1963

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 4 (AR)</th>
<th>Group 5 (AR)</th>
<th>Group 8 (AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>17</td>
<td>5.666</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>4</td>
<td>16</td>
<td>17</td>
<td>37</td>
<td>12.333</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>3</td>
<td>10</td>
<td>10</td>
<td>23</td>
<td>7.666</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>19</td>
<td>6.333</td>
</tr>
</tbody>
</table>

The data analyzed from the first book show different patterns of talk between the groups. The group without augmented reality scaffolds embedded in the book did not verbalize any statements during reading that were coded as clarifying, questioning, summarizing, or predicting statements. In fact, the transcripts showed that they either barely spoke or did not speak at all while reading the book. When they spoke, it was typically to fix a mispronunciation. The following is a common discourse pattern in Group 14 (non-AR):
Jane: The Brownie, who held tea parties, and staged a yearly fundraiser in her carport – a neighborhood revue to fight muscular dys...<br/>

Augusta: Dystrophy.<br/>

Jane: Dystrophy…<br/>

Group 5 (AR) demonstrated more discussion while they read. Some of the AR scaffolds provided them with more background information in order to better understand the events portrayed in Birmingham, 1963. In the following example, the students had just watched a video clip starring John Green in Crash Course US History where he discussed when the Civil Rights movement began:<br/>

Penelope: Okay…so when did it begin then?<br/>

Henrietta: Wasn’t it Brown v. Board of Education? Wait…was the…<br/>

Penelope: No, when did the Civil Rights movement really begin?<br/>

Henrietta: Umm…<br/>

Penelope: I am not sure.<br/>

Henrietta: Wait…didn’t he just say World War II? Or…<br/>

Penelope: I don’t think that’s what he was saying. I think, he may have said something about…you think it’s Rosa Parks, but then it was actually something else. What do you think?<br/>

Henrietta: Umm…I think it started in World War II…I thought.<br/>

Penelope: Okay, let’s look. Yep! Yeah because he said it wasn’t…(Rosa Parks)<br/>

Henrietta: Mmhmm.<br/>

Tables 4.4 and 4.5 show the frequencies of how many times a group used clarifying, questioning, summarizing, or predicting statements while reading
Home of the Brave. The frequency counts of comprehension talk for Home of the Brave look very similar to Birmingham, 1963 for both AR and non-AR groups.

The post-concept maps show only a slightly higher average of clarifying, questioning, summarizing, and predicting statements, but the most evident difference is during the reading activity itself.

Table 4.4: Reading Activity Comprehension Talk by Elizabeth & Harriet, Augusta & Jane (Non-AR) for the Book Home of the Brave

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 4.5: Reading Activity Comprehension Talk by Anne & Emma, Henrietta & Penelope, Marianne & Charlotte (AR) for Home of the Brave

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 4 (AR)</th>
<th>Group 5 (AR)</th>
<th>Group 8 (AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td>2.666</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>3.333</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>6</td>
<td>8</td>
<td>2</td>
<td>16</td>
<td>5.333</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>.333</td>
</tr>
</tbody>
</table>

Groups 4, 5, and 8 (AR) all had more conversation while they were reading in general, and they spent time summarizing what they read, making clarifications, making
predictions, and asking questions. An example of this type of discourse from Group 4 during their reading activity in response to an AR prompt to summarize what they just read is as follows:

Anne: So they put the Japanese in Internment camps…

Emma: Why do you think they wanted to do that?

Anne: Because they were afraid of the Japanese in America were sent there to spy on them and try to hurt them like they did in Pearl Harbor

Emma: Oh…

In sum, the groups who did not have augmented reality embedded in their books spoke very little while reading the book, or not at all. Groups who did read the books with augmented reality scaffolds showed different relative patterns and frequencies of discourse types, showing evidence of comprehension. Because the small number of cases analyzed for this study, these findings cannot be generalized; however it does establish as an exploratory study a foundation for future research.

Drawing conclusions about patterns of comprehension discourse during the pre and post concept mapping activities are less clearly apparent. During the post-mapping activity there appears to be slightly more clarifying, summarizing, and questioning statements for the AR groups. Both AR and non-AR groups show similar frequency counts in their pre-map activity. For the post-mapping activity, students seemed to show a mix of different kinds of comprehension statements. For example, during the book *Home of the Brave*, Anne and Emma (Group 4, AR) both summarized and clarified, and often questioned each other. Henrietta and Penelope (Group 5, AR) had a fairly even mix of the three categories during their post-map activity and Marianne and Charlotte’s
(Group 8, AR) discourse lies between those two in terms of how frequently they used clarifying, questioning, and summarizing statements. All the AR groups exhibited less predicting statements than any other activity.

The two groups who did not have augmented reality embedded in their books were more one-sided in their comments during the post-mapping activity. Elizabeth and Harriet (Group 11, non-AR) spent nearly 75% of their talk summarizing the book during their post-map, and spent some of the time predicting. This may reflect that they were still trying to connect the book to real life. Augusta and Jane (Group 14, non-AR) on the other hand were questioning each other most of the time, during both pre-map and post-map activities.

Given the differences are so slight, however, the post-map activity may require many more case studies in order to make any real conclusions based on discourse. But the patterns that have started to emerge in this investigation show that there may be promise in future studies. This study focuses on the discourse during the reading activity to answer the research questions, and not the discourse during the pre or post mapping activity, and this information was included simply to assist in further research endeavors.

In summary, by embedding augmented reality scaffolds into a book, student discoursed showed questioning of the book, and each other, as well as summarizing what they learned so far; clarifying some misunderstandings; and occasionally predicting future events. In contrast, during reading for the non-AR groups, no discourse between group members was evident besides reading the words in the book out loud verbatim or correcting each other’s pronunciations. One of the surprises in the data was the overall lack of predicting statements. The
augmentations themselves may not have effectively encouraged students to predict future events.

The clearest example of how student’s learning a historical concept was affected by the scaffolding is from the non-AR group. While all of the non-AR groups could not distinguish between Japanese and Japanese-Americans, one group in particular believed that the Japanese were running the internment camps rather than being forced to live in them. This one example demonstrates how without any scaffolding, the book itself not only did not provide enough historical information for these students to comprehend the events accurately.

**Supporting Data from Other Groups**

This comparative case study focuses on five groups because some groups were eliminated from the full analyses due to incompleteness of the data collected (i.e., missing or corrupt audio, missing concept maps, etc.). However, in order to check the findings related to the differences in patterns of comprehension talk between AR and non-AR groups, additional groups were examined to confirm if this trend was holding beyond the 5 cases studied.

The following is a table that includes the frequency counts of comprehension talk data available during the reading activity in every group in Period 1 (Non-AR) for *Birmingham, 1963.*
Although Eleanor and Kitty (Group 2, non-AR) had some conversation during the reading activity, it still did not compare to the conversations when augmented reality scaffolds were present. The following table shows all of the groups’ data during the reading activity in Period 5 (AR) for Birmingham, 1963.

Table 4.6: Reading Activity Comprehension Talk for Groups, 1, 2, 3, 11, and 14 for Birmingham, 1963

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 1 (Non-AR)</th>
<th>Group 2 (Non-AR)</th>
<th>Group 3 (Non-AR)</th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>N/A</td>
<td>2</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>.666</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>.333</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>.333</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The excluded AR groups from the final analysis, groups 7, 12, and 13 all demonstrate higher numbers than the excluded group (Group 2) from the non-AR groups. These data align with the finding that including augmented reality scaffolds can
promote discourse in a way that supports students to engage in reading comprehension talk when reading historical fiction.

Similar findings can be seen in the data set for Home of the Brave. The following table shows all the groups’ raw data during the reading activity in Period 1 (Non-AR) for *Home of the Brave*.

Table 4.8: *Reading Activity Comprehension Talk for Groups, 1, 2, 3, 11, and 14 for* Home of the Brave

<table>
<thead>
<tr>
<th>Reading Activity</th>
<th>Group 1 (Non-AR)</th>
<th>Group 2 (Non-AR)</th>
<th>Group 3 (Non-AR)</th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
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<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Including data from Lydia and Maria’s group 1 (Non-AR) shows a similar trend for Groups 11 and 14 (non-AR). Lydia and Maria did not have any conversation while reading the book. This is in contrast to the AR group data that were collected during the reading activity. The following are the data collected for all of Period 5 (AR) during the reading activity for *Home of the Brave*. 
Table 4.9: Reading Activity Comprehension Talk for Groups, 4, 5, 7, 8, 12, and 13 for Home of the Brave

<table>
<thead>
<tr>
<th>Pre-Map Activity</th>
<th>Group 4 (AR)</th>
<th>Group 5 (AR)</th>
<th>Group 7 (AR)</th>
<th>Group 8 (AR)</th>
<th>Group 12 (AR)</th>
<th>Group 13 (AR)</th>
<th>Total number of nodes</th>
<th>Average number of nodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarifying Statements</td>
<td>4</td>
<td>3</td>
<td>N/A</td>
<td>1</td>
<td>N/A</td>
<td>14</td>
<td>22</td>
<td>5.5</td>
</tr>
<tr>
<td>Questioning Statements</td>
<td>5</td>
<td>1</td>
<td>N/A</td>
<td>4</td>
<td>N/A</td>
<td>4</td>
<td>14</td>
<td>3.5</td>
</tr>
<tr>
<td>Summarizing Statements</td>
<td>6</td>
<td>8</td>
<td>N/A</td>
<td>2</td>
<td>N/A</td>
<td>6</td>
<td>22</td>
<td>5.5</td>
</tr>
<tr>
<td>Predicting Statements</td>
<td>1</td>
<td>0</td>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
<td>2</td>
<td>3</td>
<td>0.75</td>
</tr>
</tbody>
</table>

By including John and Elliot’s group 13 (AR), we not only see that the findings are similar, but in fact even slightly higher than the other groups. These two boys discussed more and made more clarifying, questioning, summarizing, and predicting statements, than any other group.

Research Question Two

The second research question was: How does the addition of embedded augmented reality scaffolds in reading material affect student reading comprehension and understanding of a historical concept or event as measured by pre and post concept maps? Specifically, what patterns can be observed both through these changes and by comparing the maps of students who received the scaffolding with those who did not?

To try and discover the essential information for this question, I decided to use concept maps for data collection. Each group created a pre-concept map about what they already knew about the subject area. Group 11 (non-AR) said they knew nothing about
the Civil Rights Movement, and therefore did not write anything on their first concept map. The same occurrence happened for group five (AR) when discussing Japanese internment camps. This kind of absolute lack of knowledge to begin the activity made this question harder to generalize based on either the discourse or map analysis. Although both groups showed that they gained knowledge from each activity, it was unclear whether as ‘blank slates’ they would have gained more with augmented reality simulations. Although some AR cases showed gains, the numbers are still too small to make a definite statement.

After the students completed the book they made another concept map. Each group made nearly an identical map to their pre-map, but added new nodes to the concept map. Sometimes nodes were added that were not addressed in the book, but the book triggered some memory of the event or person involved in the situation. This happened more with the AR group than the non-AR group.

The following tables (tables 4.10 and 4.11) show the frequency of nodes on each map, and how many nodes the students increased with and without the augmented reality material embedded in the book:

Table 4.10: Period 1 (Non-AR Group) node gain for Home of the Brave

<table>
<thead>
<tr>
<th></th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Map</td>
<td>4</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Post-Map</td>
<td>7</td>
<td>10</td>
<td>8.5</td>
</tr>
<tr>
<td>Total Gain</td>
<td>3</td>
<td>5</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Table 4.11: Period 1 (Non-AR Group) node gain for Birmingham, 1963

<table>
<thead>
<tr>
<th></th>
<th>Group 11 (Non-AR)</th>
<th>Group 14 (Non-AR)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Map</td>
<td>0</td>
<td>11</td>
<td>5.5</td>
</tr>
</tbody>
</table>
The next table depicts the differences in pre and post-maps for the AR groups.

Overall these groups had a higher average in node count gain than the non-AR groups (see Table 4.20 & 4.21).

Table 4.12: Period 5 (AR Group) node gain for Home of the Brave

<table>
<thead>
<tr>
<th></th>
<th>Group 4 (AR)</th>
<th>Group 5 (AR)</th>
<th>Group 8 (AR)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Map</td>
<td>14</td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Post-Map</td>
<td>21</td>
<td>6</td>
<td>8</td>
<td>11.666</td>
</tr>
<tr>
<td>Total Gain</td>
<td>7</td>
<td>6</td>
<td>4</td>
<td>5.666</td>
</tr>
</tbody>
</table>

Table 4.13: Period 5 (AR Group) node gain for Birmingham, 1963

<table>
<thead>
<tr>
<th></th>
<th>Group 4 (AR)</th>
<th>Group 5 (AR)</th>
<th>Group 8 (AR)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Map</td>
<td>5</td>
<td>4</td>
<td>8</td>
<td>5.666</td>
</tr>
<tr>
<td>Post-Map</td>
<td>12</td>
<td>8</td>
<td>14</td>
<td>11.333</td>
</tr>
<tr>
<td>Total Gain</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>5.666</td>
</tr>
</tbody>
</table>

In the AR groups we see a consistent progression from pre-map to post-map. The only exception being group 5, Henrietta and Penelope, who at first identified that they did not know anything about Japanese Internment Camps (see Figure 4.1)
If we go solely by how many more nodes were gained from pre-map to post-map, we can see that the group that received the AR books averaged more node gain in both books. The following bar graph shows the difference between the AR group and the non-AR group node gain (see Figure 4.2):

Figure 4.2: *AR vs. Non-AR group node gain*
The numbers in this study are very small, and therefore no conclusion can be drawn or generalization made, however the positive results found in this study should encourage future research in using augmented reality simulation embedded in historical fictions.

My participant observations, outside of the transcripts and concept maps showed that the students who had the augmented reality enjoyed the activity more. One of the students (Darcy) using the AR commented that he would have much preferred to stay and work on more books, because this was fun, and he was really learning. I asked a few of the groups, when the audio recorder was off, about how they felt about the activity, and I received positive feedback from each of them. A couple of the girls even began a conversation about which book was better. I did not have a chance to speak to many of the groups that did not have AR in their books, but from my observations this was just another activity, and they were in a hurry to move on to the next group assignment.

The conversations captured in the transcripts did not reflect much of a difference in conversational style between AR groups and non-AR groups while doing either the pre or post concept maps. The conversation went back and forth about what they wanted to put next, occasionally asking each other a question about what they wanted to write down, or asking for some clarification. This student discourse cannot be said to be a campfire style of conversation, as there was never two different viewpoints. It was more of a brainstorming session. This was similar for both AR and non-AR groups. The major difference and that we can take out of the data is that there was a difference in conversation and a clue into a deeper understanding of the discipline whilst reading the historical fiction book, when AR was present.
Chapter 5

Discussion

Research question 1

The results for the first research question were the most intriguing. Although there was little difference in discourse when working on the pre and post-concept maps, there was a large difference while participating in the reading activity. This finding suggests that by embedding augmented reality media and scaffolds inside a historical fiction book, students may be more apt to speak to one another, ask questions, and learn better through collaboration. What is not explored in this research study is what the difference would be without a reading partner. Without asking each other questions, would there be as much evidence of reading comprehension?

In regards to the discourse between the two partners, this study showed that by embedding augmented reality scaffolds into books, we see evidence of reading comprehension strategies such as clarifying, questioning, summarizing and predicting. Summarizing was the most common statement made in the AR groups, and predicting was the least common strategy. Future research may want to find ways to prompt more predicting statements from students within the augmented reality simulations to further assist reading comprehension. This also supports and demonstrates that the scaffolds assist students in the five characteristics of a reader who learns content (Goldman, 2012); 1. Successful readers use a range of strategies when they realize they do not understand
what they are reading, 2. A successful reader is able to explain concepts in the text and relate different concepts within a text to each other and to prior knowledge, 3. Successful readers sometimes generate self-explanations during reading, ask questions that probe the connections among parts of the text, or seek explanations, 4. They use cues to the logical organization of a text to guide their comprehension, and 5. They rely on multiple types of knowledge as they try to interpret print (p. 93).

AR enabled the historical fiction to become interactive, so the reader did not need to remain a passive recipient of the information, which is discussed by Dole, Duffy, Roehler, and Pearson (1991) as being necessary. This is evidenced in the discourse as students having many discussions when augmented reality was present, and a lack of discourse when augmented reality was absent.

This study also supports theory put forth by Palincsar and Brown (1984) in reading comprehension by showing students exhibiting four activities while reading a book; clarifying, predicting, summarizing, and questioning. These were often present during the reading activity in the groups that had AR books, but they were never present in the groups that did not have AR books. An example of this is group 14 (non-AR), not knowing if *Home of the Brave* was about the Japanese or Americans, where group 4 (AR) knew it was Japanese Americans and Hawaiians. The augmentations seemed to help students clarify this, whereas the groups without augmentations were sometimes left confused. By using augmented reality, scaffolding the text in a way to promote discourse, students were often enabled to discuss with one another, which increased comprehension as well as decreased misconceptions.
This study relied heavily on theory put forth by Billinghurst and Dünser (2012) on augmented reality books. These researchers suggest finding ways to use AR in the general classroom, and this study showed that AR books might increase collaboration and student discourse while reading historical fictional books. This study builds on their work by showing that AR books may increase reading comprehension as well increase comprehending complex social studies concepts.

Quintana et al. (2004) scaffolding framework included prior knowledge, question prompting, and corrective feedback (see Table 2.2 and Table 3.2). This study helps further inform their study in all three categories. In regards to the first research question prompting scaffolds helped improve discourse greatly, showing reading comprehension in student discourse. Students often conversed by question prompts, and sometimes found misconceptions in their reasoning, and helped correct each other’s misconceptions. Corrective feedback was not present in every augmentation, but when it was provided the material was then often included in the concept maps. Looking at the discourse, it also helped clear up student misconceptions. If the corrective feedback was not present, students may have continued on believing misconceptions.

**Research question 2**

Although there is much to look at through the discourse analysis in regards to research question two, there is not as much to glean from the concept maps. The findings from this study showed only a slight increase in node count in the cases that had augmented reality scaffolding embedded in the historical fiction books. Future research
may want to try a different approach in examining students pre-knowledge and post-knowledge, for example, using closed-concept maps instead of open. This may prevent nodes from inexplicably disappearing from one map to the other, and the way students are connecting the events and people may become clearer.

The slight increase in node count for the AR cases is encouraging, but interpretations are limited due to the small sample size in this comparative case study. Some students had existing knowledge about Japanese internment camps, whereas some had none. This made the node gain high for some students, and not as high for others. Seeing such a large gain for any student is encouraging, but it makes finding trends in such a small sample of concept maps difficult, especially without any descriptive analysis. Students who had no identified prior knowledge would have a higher gain score than those who did. This makes it very complicated to determine whether patterns in concept map gains were more robust for the AR cases. Future research studies may want to do pre and post-tests instead, or a simple survey.

Many researchers suggest it is necessary for students to connect new and prior knowledge (Dole et al., 1991; Goldman, 2012; Palincsar & Brown (1984); Quintana et al., 2004; Rumelhart & Ortony, 1977). This was difficult to assess in this study, as many of our groups exhibited either little or no prior knowledge about the books. Because of this, the pre-maps and post-maps gave us little information in regards to comparing growth across cases.

Students were sometimes confused about what was expected of them in the post concept map. For example, students would not think to include anything from their first concept map, leading the map to appear smaller. When I informally asked them
afterwards why their second concept map was smaller, they stated that they just thought I
wanted to see what new things they learned. This led to the maps appearing smaller, as
well as a lack of visible connections between what the students already knew and their
new knowledge. The following image shows a concept map with the same number of
facts in pre and post-maps, but the facts are different. I then saw the group stick post-it
notes in which they had written down their facts from their pre-map onto the post-map
board before they took a picture of their map (see Figure 5.1).

Figure 5.1: *Group 8 (AR) Pre and Post Concept Maps for Home of the Brave*
By doing this, it makes it difficult to examine the connections the students have about events and people and how students perceived the events.

It was difficult to draw real comparisons across the five groups, when each group had such different results. Student discourse and participant observations allowed for some insight into the happenings behind the creation of the concept maps, but the maps themselves gave very little to answers to the research question. Student discourse did show trends of students learning more with embedding AR into books about historical events, but patterns were difficult to detect within the actual concept maps.

Implications for Future Research

Structural Knowledge

This study shows some of the possible complications in using open-ended concept maps with seventh grade social studies students. Tarcani and Clariana (2006) suggest using concept maps to measure structural knowledge. In this study, it was difficult to do this as students often took nodes off their post maps that were included in the pre-maps. There never seemed to be any reason for this, except it was a topic that was not directly discussed in the book. This happened in both the AR cases and the non-AR cases. The lack of nodes on some pre-maps also made it difficult to draw any conclusions about gains in structural knowledge.

It was also difficult to determine knowledge structure and interdependence between topics, events, and people because groups sometimes only branched from the
center node, and never from another node. The data collected did not show any reasoning behind concept-map structure, but only broad topics related to the main topic. Because of this, an expert map was never used to evaluate the maps like initially planned. Instead an analysis took place to simply identify how many more nodes were gained from the pre-map to the post-map. A second iteration of this study needs to focus on changing this particular issue.

**Augmented Reality**

Dunleavy (2014) describes three design principles, which influenced the AR design for this study; 1.) Enable and then challenge, 2.) Drive by gamified story, 3.) See the unseen. This study addresses how these strategies may be applied to augmented reality books. By using question-prompting, students showed signs of being challenged. They were given more information in picture or video format, and then they were given tasks, such as answering questions or creating screencasts explaining what they knew prior to reading, and what they picked up from reading the book.

The AR book designs in this study did not include traditional gamification strategies. Both Dunleavey (2014) and Schrier (2005) identify a gamified story as an important element in learning with augmented reality. It may be helpful to include more gamification in the next iteration in this study, or future research studies. Students were given tasks, challenges, and questions, but more elements of gamification could be included next time to help students monitor their progress through the book and in answering question prompts.
However, this study did focus on seeing the unseen. In both AR books, *Home of the Brave* and *Birmingham, 1963*, there was often text that referred to important historical figures and events in history. If students held no prior knowledge of these events or people, they often failed to understand the story. The scaffolds in this study often showed pictures or videos that visibly showed students the events or people the book referred to. Students often discussed these scaffolds, and they sometimes were present in the post-concept maps. Future research should also have large sample sizes if possible, and attempt to examine reading comprehension techniques in books that do not include pictures. As shown in Chapter 3 (see Figure 3.2) some of the images in the book were used to evoke certain emotions and memories. If the book contained no images, and the augmented reality simulations were triggered by QR code or word recognition instead, the results could tell a different story.

**Disciplinary Literacy**

This study informs the research on disciplinary literacy. It is an example of how augmented reality may be able to assist teachers how to encourage and support students in learning their discipline through reading. Goldman (2012) derived five strategies that successful readers perform when reading to learn a discipline. Augmented reality was used in this study to scaffold students using each of these strategies, by having them monitor their comprehension and use a range of strategies during complicated passages. The augmentations enabled students to explain concepts in the text and relate different concepts within a text to each other and to relevant knowledge they have already acquired.
via the concept maps. The augmentations encouraged students to generate self-explanations during reading, ask questions that probe the connections among parts of the text, or seek explanations. It helped them use cues to the logical organization of a text to guide their comprehension. The last successful strategy is for students to “rely on multiple types of knowledge (for example, knowledge of words, concepts, sentence structures, text structures, genres) as they try to interpret text. By contrast, students who are weak at comprehension tend to restate or paraphrase texts, substituting synonyms or reordering the words, rather than explaining. Any connections these readers make or questions they ask tend to be superficial” (Goldman, 2012, p. 93). This study does not use augmentations to inform this strategy, but it could be a focus of a future study.

This study focused on reading to learn history, but the goal is to be able to use augmented reality in a variety of disciplines, by showing how it can assist students in these five disciplinary reading strategies.

**Limitations of the study**

The biggest limitations of this study were the duration and small number of cases. Data were only collected for a two-week period; collecting more data and using more books could have led to richer data analysis. Although there were originally 11 groups (3 groups did not give assent to participate in this study), most of the groups had incomplete data, and therefore could not be fully analyzed. Had we had a larger sample size, we may have been able to do a covariance analysis on the concept maps, making the data derived from them more easily comparable.
The final limitation is the lack of male participants. Initially there were a few males included in the study, but because of incomplete data (incomplete maps, and incomplete audio) those few groups were cut from the final analysis. Although it may not have affected the findings in this study, future research studies may want to try to attain more balance in gender.

**Conclusion**

The first research question regarding comprehension discourse shows evidence that the cases with AR books showed reading comprehension activities, which was put forth by the theory presented by Palincsar and Brown (1984). The difference between the two sets of cases during the reading activity was considerable, showing little to no conversation at all when there was no augmented reality present in the book. However, when AR scaffolds were present students often used questioning, clarifying, summarizing, and predicting statements. Students used more summarizing than any other kind of reading comprehension, and used predicting statements the least. The cases who did not use AR books showed little to none of these activities while reading.

The second research question was more difficult to answer using the pre and post concept maps, despite how much promise was shown for research question one. The concept maps failed to show real structural knowledge, and students often removed ideas, events, and people from their maps simply because they were not present in the specific book they were reading. However, if we use another method to try to examine if reading
comprehension to learn content occurred, such as student discourse, it does appear that the AR books assisted students in their comprehension.

It is recommended that future research studies continue with the second research question, but use a different method to assess student-reading comprehension. It may be more beneficial to use closed-concept maps, or provide some activities for students to do beforehand, showing them how to properly construct a concept map. Future studies should also aim to have more participants to help draw conclusions and make claims on the effectiveness of AR books on reading comprehension. The results of this study show some promise and help promote and push theory in augmented reality, scaffolding, reading comprehension, and disciplinary literacy, but more data will need to be collected and analyzed to answer how AR books can push research in structural knowledge.
References


Clariana, R. B. (2010). Deriving individual and group knowledge structure from network diagrams and from essays. In *Computer-Based Diagnostics and Systematic Analysis of Knowledge* (pp. 117-130). Springer US.


APPENDIX A
SCREENSHOTS OF AUGMENTATIONS

Civil Rights and the 1950s: Crash Course US History #39

Copy of PIONEERS OF TELEVISION | George Takei’s life in an internment camp | PBS
WWII

Internment Camps
APPENDIX B
CONSENT FOR RESEARCH

The Pennsylvania State University

Title of Project: USING AUGMENTED REALITY BOOKS TO ENHANCE CONTEXT READING IN SOCIAL STUDIES EDUCATION

Principal Investigator: Ms. Brittany D. Groff, M.Ed

Address: 18444 King William Road, King William, VA 23086

Telephone Number: (804)769-3434 ext. 526

Advisor: Dr. Susan M. Land, Ph.D

Advisor Telephone Number: (814)865-0473

Subject’s Printed Name: ________________________________

We are asking you to be in a research study. This form gives you information about the research.
Whether or not you take part is up to you. You can choose not to take part. You can agree to take part and later change your mind. Your decision will not be held against you.

Please ask questions about anything that is unclear to you and take your time to make your choice.

Some of the people who are eligible to take part in this research study may not be able to give consent because they are less than 18 years of age (a minor). Instead we will ask their parent(s)/guardian(s) to give permission for their participation in the study, and we may ask them to agree (give assent) to take part. Throughout the consent form, “you” always refers to the person who takes part in the research study.

1. **Why is this research study being done?**
   We are asking you to be in this research because your social studies teacher has agreed to have her classes participate in this research study.

   This research is being done to find out if technology tools, such as iPads, can assist students in reading comprehension to assist them in reading historical fiction.

2. **What will happen in this research study?**
   - You will be assigned a partner, and the two of you will create a concept map, showing what you already know about a topic.
   - After you are done, you and your partner will read a fictional book about the topic. The group with iPads will be able to use an augmented reality browser and view embedded supports in the book to support you in reading.
• After you complete the book, you will complete a second concept map with your partner.
• Over the next two days you will repeat the process (three days total).
• You and your partner will be audio recorded throughout the study, photographs will be taken that do not include your face, and the Principle Investigator will be taking observational notes.

3. **What are the risks and possible discomforts from being in this research study?**
   There is a risk of loss of confidentiality if someone other than the investigator obtains your information or your identity, but precautions will be taken to prevent this from happening. You will be given a pseudonym by the investigator and all data will be stored on a password protected external hard drive, in a locked room, and a locked drawer.

4. **What are the possible benefits from being in this research study?**
   4a. **What are the possible benefits to you?**
   There is no benefit for participating in this study.

   4b. **What are the possible benefits to others?**
   There is no benefit for participating in this study.

5. **What other options are available instead of being in this research study?**
   You may decide not to participate in this research. Your decision to participate in this research is completely voluntary. Your teacher may find a suitable alternative assignment for you if you chose not to participate in this study.

6. **How long will you take part in this research study?**
   If you agree to take part, it will take you about three to five days to complete this research study. Time for this study will be spent during your regular social studies class time, and no additional time of yours will be required.

7. **How will your privacy and confidentiality be protected if you decide to take part in this research study?**
   • A list that matches your name with your pseudonym will be kept in a password protected external hard drive, in a locked room, in a locked drawer.
   • Your research records will be labeled with your pseudonym and will be kept in the same password protected external hard drive, in a locked room, in a locked drawer.
In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

We will do our best to keep your participation in this research study confidential to the extent permitted by law. However, it is possible that other people may find out about your participation in this research study. For example, the following people/groups may check and copy records about this research.

- The Office for Human Research Protections in the U. S. Department of Health and Human Services
- The Institutional Review Board (a committee that reviews and approves research studies) and
- The Office for Research Protections.

Some of these records could contain information that personally identifies you. Reasonable efforts will be made to keep the personal information in your research record private. However, absolute confidentiality cannot be guaranteed.

11. What are your rights if you take part in this research study?

Taking part in this research study is voluntary.
- You do not have to be in this research.
- If you choose to be in this research, you have the right to stop at any time.
- If you decide not to be in this research or if you decide to stop at a later date, there will be no penalty.

12. If you have questions or concerns about this research study, whom should you call?

Please call the head of the research study (principal investigator), Ms. Brittany D. Groff at (804)769-3434 ext 526 if you:
- Have questions, complaints or concerns about the research.
- Believe you may have been harmed by being in the research study.

You may also contact the Office for Research Protections at (814) 865-1775, ORProtections@psu.edu if you:
- Have questions regarding your rights as a person in a research study.
- Have concerns or general questions about the research.
You may also call this number if you cannot reach the research team or wish to talk to someone else about any concerns related to the research.
APPENDIX C
INFORMED CONSENT TO TAKE PART IN RESEARCH

Signature of Person Obtaining Informed Consent

Your signature below means that you have explained the research to the subject or subject representative and have answered any questions he/she has about the research.

______________________________   ____________   __________________
Signature of person who explained this research   Date   Printed Name
(Only approved investigators for this research may explain the research and obtain informed consent.)

Signature of Parent(s)/Guardian for Child

By signing this consent form, you indicate that you permit your child to be in this research and agree to allow his/her information to be used and shared as described above.

___________________________   ____________   __________________
Signature of Parent/Guardian   Date   Printed Name
APPENDIX D
ASSENT FOR RESEARCH

The research study has been explained to you. You have had a chance to ask questions to help you understand what will happen in this research. You Do Not have to be in the research study. If you agree to participate and later change your mind, you can tell the researcher, and the research will be stopped.

You have decided: (Initial one) ___ To take part in the research.

___ NOT to take part in the research.

__________________________________________  __________________________
Signature of subject                         Date                         Printed Name
VITA

Brittany D. Groff
bdgroff@gmail.com
(814)360-9973

EDUCATION

• Pennsylvania State University, University Park, PA - PhD
  Program: Learning, Design, and Technology
  Supporting Field: Curriculum and Instruction

• Edinboro University, Edinboro, PA - MEd
  Program: Secondary Education
  Supporting field: Middle level education
  Attended: August, 2008 - May, 2010

• Lock Haven University, Lock Haven, PA - BSEd
  Program: Secondary Education
  Supporting Field: Social Studies

EXPERIENCE

• King William County Public Schools, King William, VA - Instructional Technology Resource Specialist

• Pennsylvania State University, University Park - IT Support - Graduate Assistantship

• Pennsylvania State University, University Park - Research Assistant - Graduate Assistantship

• King William County Public Schools, King William, VA - Teacher