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Exploring a Curriculum-Embedded, Constructivist-Inspired, Augmented Reality Game Within an Early Elementary Social Studies Curriculum and Its Influence on Student Experiences, Learning Outcomes, and Teacher Instructional Practices

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EXPLORING A CURRICULUM-EMBEDDED, CONSTRUCTIVIST-INSPIRED, AUGMENTED REALITY GAME WITHIN AN EARLY ELEMENTARY SOCIAL STUDIES CURRICULUM AND ITS INFLUENCE ON STUDENT EXPERIENCES, LEARNING OUTCOMES, AND TEACHER INSTRUCTIONAL PRACTICES

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Dedication

This work is dedicated to my grandmother, Marie Joan McNamara Leonhardt, who always made me feel like I could do anything. I miss you, Grandma.

Acknowledgments

Somewhere along the way, I came across an estimate that only about fifty percent of doctoral students ever finish their dissertations. Yes, that's depressing and there were many times I wondered if I would join that number. However, as Han Solo says, "Never tell me the odds"! I was fortunately able to inch forward with the help and encouragement of the many good people in my life. Therefore, I do not celebrate this accomplishment alone, and it is here I express my thanks to all those who have walked this path alongside me.

Just as research is grounded by literature, academe is grounded by mentors. I have been fortunate to have had many through the years. My committee members, Dr. Hammond, Dr. Sawyer, Dr. Garrigan, and Dr. Bishop, never failed to provide encouragement, guidance, and expertise as I worked through my project. A special thank you to my doctoral advisor, Dr. Hammond, who, through a combination of intellectual challenges, support, a mutual love of the "beautiful game", and the occasional conversation about the Star Wars universe, somehow got me over the finish line. Your "intrepid doc student" is forever grateful.

Family. We come from family and we thrive through family. My parents, my very first teachers, nurtured my love of learning and appreciation for the art of being a teacher. Thank you. My siblings, in-laws, and all of my extended family (I have a zillion cousin!) have each provided encouragement and help along the way. Thank you. Nobody, however, witnessed my journey more closely than my love, Jonathan. Thank you for being who you are – the best friend, partner, and husband I could ever have hoped for. I simply could not have done this without you. Together, we are raising two wonderful boys, Jackson and Joey, who I also thank for their patience. I am sure they heard far too many times, "Not now, buddy, Mommy is writing." or

during the more stressful moments, “I love you. Go away.” I am so privileged to be your mother. I love you both so very much.

Nobody knows the trenches of doctoral studies better than your fellow graduate students. Your classmates become your tribe, with students further along in the program offering guidance, strategies, and most importantly encouragement to those of us rising up behind them. Lehigh’s doctoral students in the College of Education are a collection of amazingly good people, many of whom I am fortunate to call “friend”. I could not have finished this degree without the support of this tribe (some of whom are now professors!). My particular cohort was comprised of wonderful people who continue to be each other’s best supporters. Bill, Raj, Duane, Adrienne, Megan, Sarah, and Y2 – thank you for the encouragement and support! Most notably, however, I want to thank Drs. Denise Bressler and Farah Vallera. Denise and Farah paved the way for game-based learning research in our program and from the beginning they have both helped me talk through ideas, supported me, encouraged me, and have become good friends. Denise led me to ARIS and introduced me to the wider GBL community while Farah led me through the not-so-scary-anymore forest of quantitative analysis. These were pivotal moments in my journey and growth as a scholar. I am in your debt.

I also want to express my gratitude for the support of Lehigh University and Lehigh University Athletics. Dr. Joseph Sterrett, the Dean of Athletics, made it possible for me to complete this degree while continuing to serve as the Director of Technology for the Athletic Department through his encouragement, support, and astounding flexibility. I couldn’t have asked for a better boss. Thank you.

Finally, this project would not have every happened without the participating students and the true partnership of the participating teachers and school administrators. I will be forever

grateful that you opened your classrooms to me and allowed me to ask so very many questions. I consider myself one of your students. I have learned so much from you all. Thank you.

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ABSTRACT

Game-based learning has entered the mainstream, yet little research has examined its influence within an early elementary setting, in the subject of history, or within the context of entire curricular unit. This dissertation examines two years' worth of data during which an augmented reality, geolocated mobile game was embedded within a second-grade history unit. Using a designed-based research approach, I designed and implemented this digital game using the ARIS platform and then examined impacts upon student experiences, student learning within and beyond the intended curriculum, and on teachers' decision-making and planning. Over the course of the two years, 58 students and 3 teachers participated.

Analysis indicates that early elementary students can experience flow and a magic circle while playing a constructivist-influenced game. While indicators of curriculum specified learning are inconclusive, data suggest that there may be a game-effect for learning beyond the curriculum, greater retention for some students, and a greater level of enthusiasm and sense of ownership of historical content. Findings also suggest teachers' perceptions of curriculum-embedded games evolved over two years from that of being an 'add-on' to being a catalyst for learning. Their role shifted from that of direct instructor to that of facilitator, thus influencing their instructional decision-making. Implications for research, game-design, and teaching are provided.

CHAPTER 1

Introduction

"Do not keep children to their studies by compulsion but by play." -Plato, ancient Greek philosopher

The Problem and its Importance

A social studies teacher decides to have his students learn about the evolution of human technology by playing Sid Meier's classic game, *Civilization V* (Firaxis Games, 2010). As students advance through the game, deciding between adopting sailing or masonry as the next technology for their ancient civilization, what is happening in terms of teaching and learning (Squire, 2004; Moshirnia, 2007)? Are the students learning more than they would through traditional instruction? Is the teacher beginning to think about learning and teaching differently after using a game within the curriculum? The British poet Lord Byron is credited with encapsulating the power of words by saying, "One drop of ink may make one million think." The same sentiment may be applied to a game-based learning experience, triggering equivalent leaps in imagination, empathy, and/or understanding.

Game-based learning (GBL) has entered the educational mainstream. Educational research scientists Takeuchi and Vaala conducted a national survey of teachers in 2014 and concluded that, "Digital games have landed in K-8 classrooms," (p. 5): 74% of all K-8 teachers use digital games in the classroom (Takeuchi & Vaala, 2014). Their observation is buttressed by other sources: The 2012 Horizon report cited the adoption of game-based learning as two to three years away. The 2016 Horizon report cited the creation and playing of games as emerging trends in both their discussion of long term trends, "Rethinking How Schools Work", and the short-term trends of "maker spaces" and "collaborative learning".

This adoption has been encouraged, and perhaps propelled, by respected educational authorities advocating for the legitimacy of GBL (Dunleavy, Dede, & Mitchell, 2009; Gee, 2003; Klopfer, Osterweil & Salen, 2009; McGonigal, 2011; Prensky, 2006; Squire & Barab, 2004; Steinkuehler & King, 2009). Games are being employed across schools and across curriculums. They are being used to teach STEM subjects (Bressler & Bodzin, 2013) such as environmental science (Bell-Gawne, Stenerson, Shapiro, & Squire, 2013) and coding (Mathrani, Christian, & Ponder-Sutton, 2016), as well as social sciences such as civics and history (Blevins, LeCompte, & Wells, 2014; Schrier, 2005). Games are not going away; they are here to stay--and grow.

The rise and prevalence of GBL in the classroom--both in practice and in its potential--justifies the need to expand the current body of GBL research. To date, much of the research has worked to validate the efficacy of GBL, and a solid groundwork has been established. In short, games for learning, when well designed and well implemented, work well to promote student learning (Hoffman & Nadelson, 2010; Gee, 2003; Prensky, 2001). However, it is time for research to turn toward deeper more meaningful questions. What role does GBL play in the entire instructional context--how does it influence not just students' learning outcomes but their learning behaviors? How does it not just augment or supplement teachers' instruction but change their instructional decision-making? To date, the theoretical underpinnings of GBL have been tenuous at best with relatively few studies providing guidance as to how established learning theories could guide future research and practice (Qian & Clark, 2016; Wu, Hsiao, Wu, Lin, & Huang, 2012). The majority of GBL research has been focused on studying knowledge acquisition while there continues to be, "a dearth of high quality empirical evidence concerning how games in the classroom might impact the development of 21st century skills," (Qian & Clark, 2016, p. 51). As we continue to build upon the established literature that validates the

efficacy of GBL, we must also begin to ask questions that extend beyond the simplicities of immediate learning outcomes. We must begin to build stronger pedagogical models for GBL that are grounded in accepted constructivist learning theories. To best extract the true power and potential that games offer to learning, and thus help educators create more impactful learning environments for their students, we must better understand the impact of GBL on the whole ecosystem of education. This study intends to unlock that level, to explore the map, and see how GBL changes the teaching and learning game. Specifically, this mixed-methods, uncontrolled experiment will begin to explore how GBL impacts learning within and beyond the intended curriculum and explore how an elementary-level, curriculum-embedded GBL experience may influence teachers' actions and thoughts regarding teaching and learning beyond the game.

Two recent reviews of previous GBL research found that only about 20% of all studies were conducted with elementary (K-5) populations (Hwang & Wu, 2012; Qian & Clark, 2016), with only about 7% specifically examining social studies education (Hwang & Wu, 2012). Upon further review of the available literature, I also found very few studies focusing on young elementary populations (K-3). In addition to exploring more deeply the impact of GBL in the classroom, this study will also look to add to the small body of young elementary GBL research by addressing the social studies curriculum. Researchers have found evidence to suggest that social studies is a particular challenge in elementary school: many elementary students find social studies boring, not relevant to their own lives, and don't recognize how social studies is important in understanding the world (Zhao & Hoge, 2005). While this characterization of social studies cannot be generalized across all classrooms, research does suggest a concerning trend that is worth addressing.

Research Questions

This study endeavors to answer the following research questions:

1) In a second-grade history unit, what are student experiences playing a curriculum-embedded game?
2) In a second-grade history unit, what effect does curriculum-embedded gameplay have on…
    a) students' learning & retention of curriculum-specified content?
    b) students' learning & retention of concepts beyond those specified in the curriculum?
3) In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

Rationale

In role-playing games, players must periodically check their game character's inventory. In doing so, the player understands what they have achieved thus far and gains insight as how best to proceed next. A literature review, or research rationale, is much the same. As explorers in the field of GBL, we must understand what paths have already been well traveled and what challenges our fellows have experienced in order to understand where to explore next and what challenges to tackle.

For the purposes of this dissertation, I define game-based learning as simply learning through games, or more specifically, the use of gameplay to generate learning outcomes. While the specific field of game-based learning is not steeped in volumes of literature going back centuries, its roots are certainly based in theoretical frameworks going as far back to ancient philosophers such as Plato. Humans see value in play and established educational theorists have touted the purpose and rationale for play (see, for example, Dewey, 1916; Huizenga, 1949; Piaget, 1962; Vygotsky, 1978). While a GBL-specific learning theory has yet to be established

(Wu, Hsiao, Wu, Lin, & Huang, 2012), games that reward skill rehearsal and recall can trace their theoretical underpinnings to behaviorist theory (Charsky, 2010), whereas more complex games, games that require problem solving, critical thinking, and/or systemic thinking can find theoretical grounding in constructivist theories (Obikwelu & Read, 2012).

Modern researchers have established that children are motivated by games, learn with games, and believe they are highly capable of playing games (Hoffman & Nadelson, 2010; Gee, 2003; Prensky, 2001). Additional research (Admiraal, Huizenga, Akkerman, & Dam, 2011; Bressler & Bodzin, 2013; Inal & Cagiltay, 2007, Sherry, 2004) has found that games have the potential to generate flow experiences, as described by Csikszentmihalyi (1990), and that flow can be an indicator of learning while playing games (Bressler, 2014; Brom et al., 2014; Hamari et al., 2016; Hou, 2015). When gamers enter the "magic circle" of a game, a place where the player temporarily suspends their belief of the real world and all its laws and rules and adopts the "reality" of the game's world (Klabbers, 2007), and they experience flow, the resulting experience is potentially quite powerful. Understanding how and why this power can used to create effective learning experiences is both a worthy and timely pursuit.

Scope & Limitations

Implementing a constructivist-informed approach, I developed an augmented reality (AR), place-based digital game that encourages higher-order thinking and meaning-making for 2nd-grade participants in a history unit on colonial Moravian life. Learning will be examined through a lens of Vygotsky's (1967) pivot theory. Csikszentmihalyi's (1990) flow theory and Huizinga's (1949) concept of the "magic circle" will be used to examine student engagement. Successful game-based learning creates the conditions for flow and induces a magic circle, while providing a model of a curricular construct that the player explores and assimilates.

This study also deliberately chose the academic subject of history as the curricular target of the digital GBL experience because history is well-suited for an AR, place-based digital game, and because research suggests that social studies instruction is in dire need of improvement. (It should also be noted that I conveniently had access to an elementary school that was very eager to "do something different" with their second-grade history unit through my role as a parent of children attending the school. It was a very serendipitous set of circumstances!) The national movement toward curriculum standardization and high-stakes testing has led to a decline in social studies instruction as teachers are pressed to focus on subjects included in "high stakes" testing leaving little time for subjects like history and civics (Fitchett & Heafner, 2010; Fitchett, Heafner, & Lambert, 2014). Given the lack of emphasis on social studies, it is not surprising that many students have a negative perception of social studies, finding it boring, not relevant to their own lives, and not understanding its importance (Zhao & Hoge, 2005). This marginalization of social studies is concerning because it is these subjects that help our children become better citizens of our world, more educated voters within our own democracy, and better at understanding global implications of far reaching initiatives and policies.

In response to this problem, the National Council of the Social Studies has recommended a constructivist approach where students build their own meanings, participate in active learning, and learn within contexts that are relevant to their own experiences (Myers et al., 2006). A teacher's role within this paradigm is changed from "sage on stage" to someone who facilitates, scaffolds, and guides students on their quest to make meaning. Game-based learning is well-suited to support this approach as games are inherently learner centered, focused on player agency, and provide a flexible platform on which to design activities that require higher order

thinking and meaning making within relevant contexts (Steinkuehler & King, 2009; Boyle, Connolly, & Hainey, 2011).

Just as games provide many affordances to support a constructivist approach in social studies, augmented reality is well-suited to aid in the particular subject of history. AR is when technology inserts additional information on top of one's perceived reality. This information could take almost any form including images, text, video, or sound. This technology allows game developers to place information into real world contexts essentially bringing the players surroundings "to life". For example, AR can enable a player to stand in the very spot George Washington stood over 200 years ago and see an image of George Washington superimposed over that location through the screen and camera of his or her mobile device. AR allows the player to be in the actual physical location that Washington stood and see a representation of Washington standing in that historically accurate location, providing in-context learning.

Methods & Data

This study was a mixed-methods, uncontrolled experiment. The game was played by dyads or triads of second grade students in an urban private elementary school. Students sharing an iPad navigated the historic district surrounding their school while completing quests and leveling up by collecting items, answering questions after reading historical markers, "talking to" historical figures, and exploring the historical sites around them. The students were also required to use their map-reading, geospatial orientation, and emerging reading skills to navigate the game environment. Data collection occurred over two years and included flow scores, student and teacher interviews (Appendices F and H), pre/post unit tests (Appendices C and D), pre/post gameplay tests (Appendix I), observed classroom instruction, and collected samples of student work. Analysis of this data included quantitative methods to examine intended learning

outcomes, and flow experiences while qualitative methods were employed to examine learning beyond the curriculum and to explore the effects of GBL on the participating teachers' instructional practices and decision making.

Significance of the Study

Not only does this study seek to establish that constructivist game-based learning can be effectively implemented with students as young as second grade, it also explores GBL as an embedded curricular activity and not just a stand-alone event. To fully exploit the potential of GBL, gameplay must be integrated within the curriculum design, viewed by teachers and students as a coherent component of curricular content, thus propelling learners to adopt the game as a pivot (Vygotsky, 1967) for understanding.

To fully understand the implications of this study, one must first effectively examine the related body of existing research. The next chapter will lay the foundation of empirical evidence that is the basis for this particular study.

CHAPTER 2

Review of the Literature

"When children pretend, they're using their imaginations to move beyond the bounds of reality. A stick can be a magic wand. A sock can be a puppet. A small child can be a superhero."
- Fred Rogers, American children's television host

Before we can follow Rogers into the unconstrained world of imagination, we must review the existing literature on the topics of games, learning, elementary education, and social studies. For the reader's reference, the research questions are listed below:

Research Questions

1) In a second-grade history unit, what are student experiences playing a curriculum-embedded game?
2) In a second-grade history unit, what effect does curriculum-embedded gameplay have on…
    a) students' learning & retention of curriculum-specified content?
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3) In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

Why games?

Both the wisdom of practice and education research confirm that learner motivation is a key variable in the learning process, (Bandura, 2002; Palmer, 1998). Many researchers have explored the intersection of learning and motivation extensively and have found there is indeed a relationship between motivation and learning (Dweck, 1986; Gottfried, 1990). In fact, there is an entire journal dedicated to this very topic in educational psychology, *Learning and Motivation*, continuously published since 1960. Skinner's behaviorist theory, for example, demonstrates how external stimuli can motivate behaviors, including learning (Skinner, 1950). Constructivist

theorists such as Bruner and Bandura argue for the importance of intrinsic motivation in the learning process by suggesting that learning is most effective when learning has become autotelic and the learner is acting with a sense of agency (Bandura, 1997; Bruner, 1983). A motivated learner will persist and be cognitively engaged to go beyond merely completing an assigned task and will seek to create their own meaning from the experience.

Other theorists, such as Ausubel (1949), suggest that motivation to learn is best encouraged through well-designed instruction because the desire to learn is natural for humans. Regardless of the theoretical approach, motivation is an established requisite element to meaningful learning.

But, why games? Games are motivating and, as landmark researcher James Gee has observed, "motivation is the most important factor that drives learning. When motivation dies, learning dies and playing stops...Since good games are highly motivating to a great many people, we can learn from them how motivation is created and sustained," (Gee, 2003, p. 3). Research has shown that young people are highly motivated to play games and possess a high level of self-efficacy when playing games (Hoffman & Nadelson, 2010; Gee, 2003; Prensky, 2001). If a parent asks a child who is fully engaged playing *Minecraft* to stop playing, the parent must be prepared for at least a modicum of resistance. True, young people are also highly motivated to watch television and engage with other forms of media, yet television in the classroom is a fad that has come and gone (Reiser, 2001), and as Gee (2003) pointed out, "good" games are different than other media. First, a substantial and growing amount of research shows that kids can learn from games (Steinkuehler & King, 2009; Van Eck, 2006). Next, games offer specific, unique affordances for learning such as providing contextually relevant information "just in time", adjusting challenges to match the player's current skill level, being player/learner

centered, minimizing the fear of failure, and requiring player/learning agency (Gee 2003; Prensky 2001). Neither television nor YouTube are able to accomplish these things. Additionally, the excitement for game-based learning is growing, not slowing. Tyton Partners, a consulting and advising firm specializing in the educational marketplace, predicted that investments in game-based learning companies would increase twenty percent from 2015 to 2016 (Tyton Partners, 2016). While data does not yet substantiate that prediction, a recent survey found that 74% of K-8 teachers are using digital games in the classroom (Takeuchi & Vaala, 2014). Finally, games are an incredibly flexible platform on which to design instruction. Games can address a myriad of curricular content areas, be designed within a variety of game-frames such as "sandbox games", "first-person shooter games", single-player experiences, or massively multiplayer online games (MMOGs). Games can also be played on a multitude of devices such as a computer, tablet, mobile phone, or game console, and in almost any space including the classroom, on a field trip, outside, or even at home (Snow, 2016; Squire 2006). Games such as *First in Math* can embrace the power of extrinsic motivation by awarding stickers and badges for mathematical achievements whereas other games, such as *Minecraft*, rely primarily upon the intrinsic motivation of players to persist (Murphy, Chertoff, Guerrero, & Moffitt, 2011). The motivational power, the ability of games to aid with learning, and the flexibility of the "gaming" platform all point to the potential power of educational gaming.

What is a Game? The Challenge of Definition

The flexibility of games inherently makes it difficult to define exactly what makes a game a game. Both players and non-players can agree that *First in Math*, chess, soccer, and *Super Mario Bros.* are games. But what about activities such as *Minecraft*? *Minecraft* is a space in which a player can essentially play forever, continuing to build and mine and avoid (or

destroy!) the mobs that invade his or her world. Is this a game or is it simply an activity? A world? A platform? A sandbox[1]? *Minecraft* was originally published in 2011 as a commercial game and quickly became incredibly popular. It was not designed to be a learning tool. And yet, just a few years later, one of the largest technology companies in the world, Microsoft, purchased Minecraft for $2.5 billion and quickly began to leverage it as a powerful learning tool for schools (Ovide & Rusli, 2014). Defining the word "game" has been an ongoing debate among scholars, game developers, and players alike for many years (Suits, 1967; Waern, 2012). If we are going to explore the power of games and the gamer experience, we must first understand what a game is or is not.

Turning to authorities, we find multiple definitions of what makes a game, and these definitions only partially overlap. The Merriam Webster dictionary defines game as an "activity engaged in for diversion or amusement". Many games also have a "win state," in which one player or team achieves a successful outcome while the others do not. Many traditional games have a binary win state (one baseball team wins while the other loses; one tennis player advances to the next round while the other does not), but diversified winning is also possible: a golfer can be three strokes off the lead but still "in the money". Games can be competitive, as in the previous examples, or collaborative, as in *Dungeons & Dragons* or *Fortnite*. Sid Meier, creator of the wildly successful digital game *Civilization*, defined "game" as simply a series of interesting decisions (Meier, 2012). Bernard Suits, a philosophy professor who is credited with the term "lusory attitude" (the attitude a player must assume to play a game), defined games as, "the voluntary attempt to overcome unnecessary obstacles" (Suits, 2007, p. 14). These

[1] A sandbox game is an open, non-linear game where a player is free to roam, explore, and interact at will. These games, often played in "worlds", may provide some structure and objectives, but players do not need to engage in this proposed structure to successfully play and enjoy the game. While there may be classic "mini-games" available during play, there is often no clear "win-state" in the full game.

definitions enable us to be inclusive when we talk about games, but they do not really convey the power of the gaming experience and thus, the potential of the gamer-as-learner experience.

In light of this diversity of definitions, some researchers and game designers have proposed various "checklists" of characteristics, or game mechanics, that a game must possess in order for it to truly be a "game", and many of these are valuable road maps when it comes to game design. Katie Salen, a recognized authority and scholar in game design and game-based learning (GBL) who has led projects such as the Quest to Learn school in New York and The Institute of Play, defined a game as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (Salen & Zimmerman, 2004, p. 11). While Jane McGonigal, a highly regarded game designer and author of books such as *Reality Is Broken: Why Games Make Us Better and How They Can Change the World*, doesn't include an explicit "win-state" in her definition, she does propose a similar list of concrete characteristics when defining a game. "When you strip away the genre differences and the technological complexities, all games share four defining traits: a goal, rules, a feedback system, and voluntary participation," (McGonigal, 2011, p. 21). While each of these definitions, and many similar others, can guide game developers in creating an activity that looks like a game, ultimately, all games are striving to create a true "gamer experience", something that feels like a game, that invokes the "passion" of *Minecraft*, which is something that's a little more nebulous. It is this gamer experience, however, that explains a player's motivation to keep playing a game like *Tetris*, a game which has no possible (eventual) outcome other than failure.

McLuhan's (1964) concept that "the medium is the message" is perhaps an apt approach when considering a shift in focus from defining the construction of games to understanding the gaming experience. McLuhan (1964) noted that researchers were incorrect in studying the

impact of television on society by simply measuring content preferences, viewing time, and vocabulary counts, and although he was referring to television and printed books when he said, "program and content analysis offer no clues to the magic of these media or to their subliminal charge" (p. 9), the same premise applies to the medium of digital games. If we shift our research focus away from the lists of game mechanics and design elements and move toward an understanding of what an ideal game experience is, then we can truly understand the power of games and transfer that power into effective learning experiences. We begin to see why "passion" is so important in game-based learning and why there is magic in the medium of games.

The Gamer Experience - Flow & The Magic Circle

Some researchers have examined the gaming experience through the lens of Csikszentmihalyi's (1990) Flow theory or through a concept called the "Magic Circle" (Klabbers, 2007). By examining the gamer's experience, or the aesthetic value of the game, then we can begin to understand why players persist even if they are doomed to failure and why they strive to understand and create meaning around concepts and ideas that do not appear to have any real-life relevancy.

Flow, as described by Csikszentmihalyi (1990) is a psychological state of optimal experience and enjoyment. Characterized by intense concentration, losing oneself in the moment, a sense of agency, losing one's sense of time, and being intrinsically motivated, flow enables activities to become autotelic. Athletes often describe the feeling of flow as being "in the zone," a state in which action seems to precede thought. A flow experience is possible when there is an ideal balance between the challenge of an activity and the ability level of the participant. This

state of total immersion and enjoyment is something that gamers are seeking to experience and that game developers are seeking to create.

While Csikszentmihalyi's theory of flow arose from his interest in the intense focus adult artists often exhibited while working, his work has been expanded to include children and has been applied in many fields, including the study of games. Custodero (2005), for example, studied flow in young children exposed to various musical environments while Sherry (2004) shows the parallels between Csikszentmihalyi's conditions for flow and the characteristics of video games:

> ...video games frequently (a) have concrete goals and manageable rules that are often detailed both in the game, the game packaging, and on game websites; (b) provide action that can be manually or automatically adjusted to our capabilities; (c) provide clear feedback in terms of running scores, collections of artifacts, or progress reports; and (d) have abundant visual and aural information that helps screen out distraction and facilitate concentration…Video games possess ideal characteristics to create and maintain flow experiences in that the flow experience of video games is brought on when the skills of the player match the difficulty of the game. As with other flow experiences, difficulty increases as the player's skill increases (p. 339-340).

While the conditions for flow are often present during gaming, flow is not unique to gaming. A person can experience flow through a variety of activities such as climbing a mountain, playing an instrument, or painting a picture. To create the unique gamer experience, flow must be accompanied by another critical element: The Magic Circle (MC). Games have been described as mimetic in they can be viewed as representations of the real word, however researcher Laurel (1991) argues that computer generated environments, such as digital games,

are fundamentally different in that they "blow a third dimension into the concept [of mimeses] by adding interactivity — the idea that users can become co-creators, collaborating at the deepest levels in the shaping of a mimetic whole", (p. 7). This convergence of the mimetic and of agency separates games from other art forms and creates what other scholars have referred to as the Magic Circle (MC). The MC is an understanding or agreement between the game and the gamer where the player is invited to temporarily suspend belief of the real word and all of its accompanying rules and laws and norms (Klabber, 2007). The player adopts a new persona and accepts all of the constraints and freedoms granted by assuming this role. Huizina (1949, p.10) describes this departure from reality by describing magic circles as "forbidden spots, isolated, hedged round, hallowed, within which special rules obtain...temporary worlds within the ordinary world, dedicated to the performance of an act apart." To fully experience the magic of a game, a player must accept and embrace all of the non-ordinary elements contained within the MC created by the game thus adopting a lusory attitude. Without a willingness of the player to fully submit to the magic circle, the game loses its appeal, and the lusory attitude dissipates. Therefore, the magic circle must be robust. It must be able to withstand external distractions and be compelling enough to illicit a willingness to participate that is internally motivated. Within the circle, players are given permission to go beyond regular thought and make unbounded decisions. For example, failing in a game is not devastating - players can restart and continue playing - and thus players have a freedom to "die and retry", sometimes even doing so on purpose to test an idea or strategy. The freedom to depart from the "real world" and assume a new role sets the stage for a gamer to explore and grow without the hindrance of perceived limits aiding in the process of "meaning making" that is at the core of constructivist learning (Dodig-Crnkovic and Larsson, 2005). Although the concept of the magic circle significantly precedes the

creation of the first video game, scholars have continued to use the magic circle to describe the gaming experience (Klabbers, 2007; McGonigal, 2011; Walz & Deterding, 2015).

Games and Learning

The use of games for learning is not a novel idea; the concept of game-playing as an instructional tool spans a diversity of topics, settings, and time periods. *Go*, a game developed in Japan around 2500 BC and chess, a game developed in India around 500 BC, were used to hone the strategic thinking skills of warriors well into the 18th century. Today the US Army utilizes the digital video game *America's Army* to teach some of the very same thinking (Smith, 2010). Games have also been specifically aligned to formal curriculum. In the early part of the 20th century, University of Pennsylvania professor Scott Nearing aligned a commercial game, *The Landlord's Game* (the predecessor to *Monopoly*), to his curriculum in an effort to increase his students' understanding of economic principles (Kelley, 2016). This approach to "backward-designing" commercial games to fit into curriculums continues to be popular with games such as *Civilization*, *The Oregon Trail*, and today's version of *The Landlord's Game*, *Monopoly* often being used in classrooms to further learning. Not surprisingly, a formal industry of "educational gaming" eventually emerged, and games such as *First in Math* are being designed and marketed specifically as curriculum-aligned games (CAGs). Apple's Education website boasts over "80,000 education apps — designed especially for iPad — that cover a wide range of subjects for every grade level and learning style," (Apple Inca., 2016). Approximately 58,000 of these--just under three quarters of all educational iOS apps--are specifically marketed as "games" (Apple Incb., 2016).

Many curriculum-aligned games, both those aligned by design and those aligned via creative adoption, have the potential to generate flow experiences for learners. However, only a

certain subset of games will also create a robust magic circle. Since the middle of the 20th century scholars have been studying game-based learning (Cruickshank & Telfer, 1980; Malone, 1981), and terms such as edutainment, gamification, and serious games have been developed to describe these different types of GBL experiences.

Games that use the entertainment value of games to promote learning are often called "edutainment"; while there is nothing fundamentally objectionable with this approach, the learning is often extrinsically motivated and restricted to lower level learning, such as fact recall (Charsky, 2010). Charsky (2010) describes how the classic early digital game *Carmen Sandiego* does a good job of providing drill and practice for geographic locations as the game character follows clues on her way to her next destination but does little to promote deeper understanding or learning. Another study (Flaherty, Connolly, & Lee-Bayha, 2005), funded by the US Department of Education, examined the efficacy of playing *First in Math* (FIM) - a game designed to provide practice and reinforcement of basic computational math skills. Players earn stickers and badges as they advance through various games and levels. The study found that playing FIM did have a small but statistically significant positive effect on achievement scores. These are examples of games that do not create the types of ideal immersive experiences mentioned above (flow + magic circle) but yet generate positive, lower-level, learning outcomes by combining classic drill and practice (also known as drill-and-kill) with extrinsically motivating game mechanics.

Although edutainment games can provide opportunities for skill practice and enhance recall, when the "gaming element of the product is used as a separate reward or sugar-coating for completing the educational content" (Habgood & Ainsworth, 2011, p. 5), these types of games can aptly be described as "chocolate covered broccoli" (Bruckman, 1999). The learner is

extrinsically motivated to eat his broccoli (practice the skill) and get all of the associated nutritional value (recall). While the food probably tastes a little better going down, it's still really just broccoli...and the learner knows it. Nobody is truly fooled, and learners do not advance past the lower levels of Bloom's taxonomy. If any magic circle is created it is tenuous at best. Without a robust MC, the gamer/learner is unlikely to fully accept the game and unlikely to have a flow experience or an immersive learning experience.

As scholars and game designers began to recognize the negative connotation and limitations of "edutainment", the technology behind digital games also matured, allowing for the development of more sophisticated "serious games" (SGs). Designed to be more complex and intrinsically motivating, these games offer the potential of a robust magic circle and flow experience. The term "serious games" has been added to GBL by many scholars seemingly as an attempt to differentiate CAGs that attempt to promote deeper more meaningful learning experiences from those that are simply designed for skill practice and recall learning. The more significant evolution of game-based learning, however, has not been in its nomenclature, but rather in the development of games for learning that can provide optimal gamer experiences and create the conditions for flow and a true magic circle. The rise of immersive CAGs in GBL is critical because it is these types of intrinsically motivating games that enable deeper levels of learning.

Flow and Game-based Learning

Research has shown that flow can be experienced during gameplay and that this type of "deep absorption in activities has been shown to promote optimal learning experiences," (Admiraal et al., 2011, p. 1186). While in flow, gamers enter a distinct psychological state of enjoyment and concentration that is observable through both behaviors and brain activity (Klasen

et al., 2011). While several researchers have used flow as a means by which to study the relationship between learning and gaming (Admiraal et al., 2011; Bressler & Bodzin, 2013; Inal & Cagiltay, 2007), more recent research has shown flow to be a definitive predictor of learning while playing games (Bressler, 2014; Brom et al., 2014; Hamari et al., 2016; Hou, 2015). By establishing flow as an optimal condition, this body of research solidifies flow as a very useful phenomenon by which to study the gamer experience and more specifically, the game-based learning experience: flow is an indicator of learning (or potential for learning) and it is also an indicator of an immersive, intrinsically motivating game experience.

While flow, as traditionally understood, has been shown to indicate enhanced learning via deep absorption and engagement, flow in games is a uniquely powerful experience if the player accepts and embraces accompanying magic circle. Within the magic circle, the flow experience of gamers becomes a transformative experience. The gamer accepts and embraces understandings, experiences, and possibilities beyond their normal constraints; they operate within the rules and boundaries of the game. They transform into a game-agent, or character, with agency whose limitations and possibilities are only defined by the rules of the game. Without the magic circle, we will struggle to capture the potential of learning through games because without an eagerness to perpetuate and adopt the intended experience, a learner's choices, decisions, and meaning-making become inherently self-limiting. Huizina (1949) describes a “spoil-sport”, one who does not acknowledge the magic circle, as the player who:

> ...shatters the play-world itself. By withdrawing from the game he reveals the relativity and fragility of the play-world in which he had temporarily shut himself with others. He robs play of its illusion...therefore he must be cast out, for he threatens the existence of the play-community (p. 11).

The magic circle, and its call to immerse oneself completely into an experience, is the "superpower" of games that allow them to provide meaning-making learning experiences for gamers/learners. Arnold, Koehler, and Greenhalgh (2016) argued that that designing for immersive experiences is a key element in maximizing the learning potential of games. Without the immersive magic circle, we lose the power of games and we're left with just another, quite possibly boring, "learning activity".

Much of the more recent research that focuses on these types of immersive games does, however, refer to this genre of GBL as "serious games," and so I acknowledge the use of the term as one that helps segment out these "second generation" games-for-learning as opposed to the first generation of more drill-oriented games. Marsh (2011) proposed an inclusive definition of serious games that placed varied gaming experiences, including media such as simulations and virtual experiences, along a continuum ranging from games for purpose to experiential environments for purpose. Marsh (2011) suggests that serious games "provide opportunities to engage in activities through responsive narrative/story, gameplay or encounters to inform, influence, for well-being, and/or experience to convey meaning," and that the success of a serious game can be "characterized by the degree to which purpose has been fulfilled," (p. 63). The common thread between the various types of serious games on Marsh's continuum is "purpose". Without a purpose, the games or experiences become purely recreational and cannot be considered serious games.

A meta-analysis of game-based learning with serious games by Girard, Ecalle, and Magnat (2013) suggested that serious games may be effective for learning but stated that more empirical evidence was required. More recently, Romero, Usart, and Ott (2015) conducted another review of the literature focusing on how serious games might advance 21st century

"skills such as innovative thinking, creative problem solving, metacognitive abilities, communication, and collaboration" (p. 151), and found that research suggests that the game mechanics inherent to serious games, such as complex collaboration, tactics, and choice, are indeed effective in advancing higher order learning.

Regardless of the nomenclature used to describe GBL, whether a game is utilizing gamification for practicing math facts (such as *First in Math*) or is a serious game (such as *It's a Deal!*, which is designed to increase intercultural communication--see Guillén-Nieto & Aleson-Carbonell, 2012), the question of whether games can positively impact learning has been answered through many studies (for example, Annetta, Mangrum, Holmes, Collazo, & Cheng 2009; Hong, Cheng, Hwang, Lee, & Chang, 2009; Oltman & Hammond, 2015).

Learning Theory and Games

As discussed, the game-based learning community agrees that games can be vehicles for learning and even promote deeper learning than some traditional methods. The game-based learning community has also made significant progress in theory, defining games vs. game-like activities, differentiating among different types of games, and establishing design principles for immersive games (for example, Arnold, Koehler, & Greenhalgh, 2016). However, the connection between games and established learning theories is weak (Qian & Clark, 2016).

While many prominent learning theories have been developed over the past century, some of which emphasize the importance of play, none was developed purely with gaming in mind. Given learning theorists' lack of attention to games and game developers' lack of attention to learning theory, it is no wonder that the connection between learning theory and game-based learning is still vague at best, (Qian & Clark, 2016; Wu, Hsiao, Wu, Lin, & Huang, 2012). The past does not have to be determinative, however; we can use learning theory to further

understand why some games, often ones that provide vastly different gamer experiences, are effective at enhancing learning. Theory offers useful paradigms for explaining the phenomenon, value, power, and limitations of various game-based learning experiences.

Behaviorist theory suggests that learning is driven by external stimuli, and that the learner is passive until prompted to act (Driscoll, 2005). Positive responses can be reinforced through rewards and other external factors (Skinner, 2003). Negative behaviors can be curtailed through negative reinforcement (Skinner, 2003). All behavior can be attributed to external forces (Driscoll, 2005). Garrigan (2017) describes this use of rewards to generate external motivation as "gamification". Gamification, as described by Garrigan (2017), is clearly the mechanism by which the game "*First in Math*" (FIM) works. A study funded by a U.S. Department of Education grant found that students were highly motivated by external stimuli to play FIM. "Teachers reported that students were excited about the game format and motivated to accumulate the award stickers and help their class "team" achieve higher rankings," (Flaherty, Connolly, & Lee-Bayha, 2005). The stickers and rankings provide the reinforcing rewards that drive continued play. "Drill and (s)kill" games such as this, where students earn points by answering questions about math or other subjects, certainly offer plenty of opportunities for practice and rehearsal and if simple, specific skill acquisition is desired, then these activities may have value (Savery & Duffy, 1995; Squire, 2003). While these games are certainly more fun than traditional worksheets, and while nobody can deny the extrinsic motivational power of these games, these games don't align well to more current paradigms of instruction (Squire, 2003) that strive to encourage deeper learning and more critical thinking. Many of these types of digital reproductions and gamified versions of the traditional workbook (or even slate and chalk!) do not go much beyond Bloom's first level of learning (Charsky, 2010). While there is certainly some

value in the acquisition of this type of knowledge, and it is clear that these types of games can help reduce the pure drudgery of the skill- or concept-acquisition process, these chocolate-covered broccoli games that rely on extrinsic motivation are not indicative of the full potential games offer to drive deeper understandings and more complex learning experiences.

Research also shows that rewards--such as tokens or leveling up--don't always work (Garrigan, 2017). For example, researchers Lepper, Greene, and Nisbett (1973) found that young children who expected a reward were ultimately less motivated to continue in a play activity involving drawing. A meta-analysis of the effects of extrinsic rewards on intrinsic motivation by Deci, Koestner, and Ryan (1999) supported this theory, called the over justification effect, that people, especially children, experience lower levels of intrinsic motivation when given extrinsic rewards.

Behaviorist approaches to game-based learning are therefore self-limiting: useful for certain contexts but not others. A logical alternative learning theory to guide game-based learning is constructivism (Romero, Usart, & Ott, 2015). Constructivist theory provides a lens by which we can examine (and design!) games for their ability to go beyond simple recall and knowledge acquisition and where we can view the gamer/learner as someone who is afforded agency in their own educational experience and is thus potentially intrinsically motivated (Schrier, 2005). Constructivist theory suggests that a learner builds, or constructs, their own personalized meaning during a learning experience by building upon their prior knowledge (Driscoll, 2005). This is contrary to a behaviorist perspective that believes that meaning is determined by external stimuli (Driscoll, 2005). A constructivist adheres to the belief that meaning and understanding come from the learner's own internal interpretation of the situation, environment, and facts (Driscoll, 2005).

Playing games is a natural impulse of humans and is one of the naturally occurring methods by which children learn. Moravian bishop John Amos Comenius, a scholar and religious leader born in the late 16th century who is often touted as the father of modern education, once said, “much can be learned in play that will afterwards be of use when the circumstances demand it,” (Comenius & Keatinge, 1896, p. 366). Constructivist theorists such as Dewey, Bruner, Jonassen, Papert, and Vygotsky have long studied the relationship between play (games) and learning. Recognizing how elemental play is to a child’s nature, Dewey argued that schools should embrace this inherent opportunity to create positive learning experiences. Writing in *Democracy and Education: An Introduction to the Philosophy of Education* (1916), Dewey asserted that “Experience has shown that when children have a chance at physical activities which bring their natural impulses into play, going to school is a joy, management is less of a burden, and learning is easier” (p.228). In Dewey’s framing, the physical and cognitive challenges of games provide an opportunity to create a stimulating learning experience. There is value to be had in learning from play.

Bruner (1983) argues for the value of play through the results of an experiment where children who were allowed to play freely with materials (sticks and fasteners) prior to being asked to solve a problem (reaching chalk that is just out of arm’s reach) performed much better than children that had been formally introduced to the same materials. The children who had been allowed to play freely, “seemed far less frustrated in carrying out the task than did the other children. They neither seemed to resent their failed efforts, nor did they feel they were losing face” (Bruner, 1983, p. 64). Interestingly, he also observed that the children who were allowed free play accepted “hints and suggestions more readily than the other children. They could be free and inventive” (Bruner, 1983, p. 64). Initiating an activity with free play created a magic

circle of sorts, a game-like environment where these children felt free to experiment and viewed any "instruction" from the researchers as simply another resource to solve the puzzle and reach the win-state.

When Jonassen, Peck, and Wilson. (1999) were trying to validate the notion that a constructivist perspective was a more natural learning process, they used the example of children playing a game, sandlot baseball. "Children who consistently hit foul balls will adjust their stance or handgrip on the bat continuously to manipulate the flight path, and they will observe the effects of each manipulation" (p. 8-9). This informal process of experimentation, reflection, and intrinsically motivated problem solving in a game is being done without conscious thought and yet is clearly a learning activity and more specifically, a constructivist learning experience. Games such as *Civilization* offer a similar constructivist experience for gamers. Players use experimentation and develop strategies that may differ greatly from any other player in order to advance their in-game civilization as quickly as possible. As they are drawn into the magic circle, their intrinsic motivation is activated, and they become curious and self-driven to strive for mastery. They learn quickly that successful strategies require balance: one can't attack every other village and still be able to defend one's own village, and so players adjust. Having to make choices that require higher-order thinking makes this game-based learning experience distinct from a behaviorism-derived game. A player participating in a game that can be matched to constructivist principles is afforded the opportunity to be intrinsically motivated to construct their own meanings and understandings through their own actions, decisions, and adjustments.

Papert's seminal book *Mindstorms* (1980) explored how computers could be used to create "transitional objects" that would allow students to bridge the gap between what they already know and what new meanings they could construct through simulations such as his

famous Turtle programs. His idea originally came from his childhood experience of playing with gears.

> The gear can be used to illustrate many powerful "advanced" mathematical ideas, such as groups or relative motion. But it does more than this. As well as connecting with the formal knowledge of mathematics, it also connects with the "body knowledge," the sensorimotor schemata of a child. You can be the gear, you can understand how it turns by projecting yourself into its place and turning with it. It is this double relationship - both abstract and sensory - that gives the gear the power to carry powerful mathematics into the mind...the gear acts here as a transitional object. (1980, p. viii)

While Papert's idea of transitional objects supports the value of models and the importance of the learner "connecting" with the learning tool, Vygotsky's theories perhaps offer some of the strongest connections between constructivist learning theory and powerful game-based learning. His Zone of Proximal Development theory (ZPD) and his More Knowledgeable Other (MKO) theory (Vygotsky, 1978) are enabled through the social nature of gaming. ZPD is the difference between what a person can do independently and what they can achieve with help. MKO, which is when a person is provided assistance or guidance for an activity by another more experience adult, peer, player, or even computer-based tutorial, is certainly related to GBL (Vygotsky, 1978). While gaming, players collaborate, depend upon the knowledge of a more experienced gamer, utilize online gaming forums, watch and learn from other players on YouTube, or even lean on the scaffolding provided through in-game resources. The inherent scaffolding found within the social gaming culture and the games themselves allows players to continue advancing beyond their own self-contained abilities and move on to higher levels, both in the literal gaming sense but also in terms of learning.

Vygotsky's (1967) Pivot theory, however, perhaps most precisely explains why games can be such effective learning vehicles. Vygotsky proposed that play in children older than three is a way for young minds to utilize their imaginations to separate meaning from a concrete object by using a "pivot". In his famous example of a child who wants to ride a horse, Vygotsky proposes that through play, a child can ride "horse" by imagining that the stick he or she is holding is a horse. Through the use of the stick, or pivot, the child is able to separate the meaning of horse from the object horse. This is a big shift from simple object identification - a horse is that (pointing to a four-legged animal) to understanding what "horse" means, an animal I can ride. As children get older, the need for pivots diminishes, according to Vygotsky, as a person's cognitive ability to prioritize meaning over object matures. "It is the essence of play that a new relation is created between the field of meaning and the visual field – that is, between situations in thought and real situations" (Vygotsky, 1978, p. 104). While playing "horse" is a simple game played by a young toddler, the same principle/theory can be applied to games designed for older children. Again, using our example of *Civilization*, the game acts as the stick, offering the player a representation of the world (the horse) through which the player can begin to construct his or her meaning of abstract concepts such geopolitics, social structure, modernization, community evolution, etc. Eventually, like the toddler understands the meaning of "horse" without holding a stick, the older gamer understands better how the world "works" without having to refer to his game.

Vygotsky's pivot theory connects the concept of the game's magic circle to educational theory. The magic circle depends upon the suspension of reality, and as Waern (2012) argued game "activities are re-signified and contain an element of pretense," (p. 6). By enabling the player to assign new significance or meanings to things and allowing for the adoption of a

different reality, the player is given a pivot and a magic circle is created. The game is the stick/horse standing in for the horse/horse. In Vygotsky's terms, the game is the pivot.

Siler (2011) used pivot theory as an explanation as to why the use of models helps humans understand, make meaning, and make connections between various elements. "Symbolic models serve as pivots that enable adults to rekindle that fundamental connection with early childhood—in particular, the ability to play with ideas and their possibilities" (p. 420). In one particularly salient example, a middle school science student created a model of a cell using the metaphor of a hockey game.

> The ice is the cytoplasm, which holds the parts of the cell together, or "skating rink." The rink is the semi-permeable membrane, which selectively allows materials to pass in and out of the cell (including the hockey skaters). The hockey sticks are the endoplasmic reticulum, or the transportation system. The Goal is the mitochondrion, which is the powerhouse. Basically, that's the name of the game. Because without the "goal" [of survival], what's the point of playing the game in the first place! And we have to smile when we see the Zamboni "lysosomes"! They're the cleaning crew of the cell." "As Farin [the teacher] noted, "The model-building and the 'unpacking' discussions they share with other students add an extra layer of discovery to the classroom" (p. 422).

While Siler's study uses Vygotsky's pivot theory to explain the efficacy and value of models, he doesn't explicitly talk about the power of games as pivots. This student's hockey game model is simply a very creative and effective model in Siler's study. The above example, however, also demonstrates the specific metaphorical power of games as models or pivots. The game of hockey--with its rules and its win-state and its dynamic action--is the student's "pivot" to understanding cell structure and function. Although the student didn't actually play a real or

simulated game of hockey in his class, his thought process and imagination were relying on his understanding and probable experience of either real-life or video game hockey.

Vygotsky's pivot theory offers a meaningful explanation of the power of games to provide learners with a bridge or vehicle to create meanings and understandings beyond what they've previously experienced. Owen (2007) argued for the value of computer games for learning while referencing the power of pivots to "stimulate the imagination and put the learner in a different place – and utilise adult and adolescent imagination as a powerful ally in learning," (p. 62). By harnessing the power of play and imagination for learning, students are free to think beyond normally perceived limits.

> When students engage in play in the...classroom, they transform classroom practice, as constituted, e.g. in the given tasks, in relation to needs and motives that are personally meaningful to them. Thus, play could offer a way for students to make new sense of what they are dealing with (Andree & Lager-Nyqvist, 2013, p. 1739).

In order for an object/model/game to be successful as a pivot, however, the learner must willingly adopt the object/model/game as a pivot, just as the gamer must willingly submit to the magic circle. The role of pivot cannot be imposed by a teacher or other.

> Vygotsky sees play as a transitional stage from a child's thinking constrained by the properties of a current situation to thinking totally free from these constraints. At this stage, a child cannot yet assign a new meaning to a play prop arbitrarily; this prop has to have some properties that allow the child to use it in a way similar to the way he or she would use the real object. It is less important that the prop resemble the object it is intended to represent than that the child be able to perform a similar action or a gesture using the prop as he or she would use the object (Bodrova & Leong, 2015, p. 374-375).

Elkonin (1976) asked children to evaluate acceptable representations of trains or carriages; they decided that only objects that could actually roll (like a pencil) were sufficient to represent trains. This choice, focusing on the rolling as the key similarity, is a good demonstration of a constraint: a pivot needs to have characteristics that the player/learner can fully understand and embrace as sensible. In terms of GBL, the challenge of a good game is now doubled: the game must be a "real game," in that it creates the conditions for flow and induces a magic circle, and it must also be a "useful pivot," providing a model of some new construct that the player can connect to. Only if a player can adopt it as a pivot does it become a game-for-learning in the constructivist sense. Through understanding Vygotsky's theory, we can explain how learners are able to construct new meanings and understandings through game play.

Affordances of Games for Learning

Even though the connections between learning theory and games need further development, game designers and educators can still readily identify ways in which games can empower learning. If a game designer or teacher is able to match the content and learners with the appropriate game, then games offer many affordances that fit well with learning (Prensky, 2006; Steinkuehler and King, 2009). As identified above, all games are learner centered, require agency, and grant the freedom to fail (sometimes, spectacularly!). Squire (2008) observed "Games are fundamentally about doing. Perhaps the biggest difference between game-based and more traditional approaches to learning is that game designers most often start with the user experience, specifically with what the user does" (p. 22). This is different from traditional instruction, which often starts with a transmissive, "sage on the stage" approach. Successful serious games continue to go further in that they are immersive, require the learner to solve problems, encourage the learner to make meaning, and are intrinsically motivating. They can

also allow for relevant, contextually based situations, discovery learning, systemic understandings, and because games are social, they can offer opportunities for peer-scaffolding. Gee (2003) notes how good games are also excellent at providing the right information at just the right time. “Good games...find ways to put information inside the worlds the players move through and make clear the meaning of such information and how it applies to that world” (p.2). Finally, if a game is designed well, it can be particularly engaging for the millennial generation (Dede, 2005; Prensky 2006) and engagement is a key predictor of learning outcomes (Garris, Ahlers, & Driskell, 2002; Linnenbrink & Pintrich, 2003).

Ipso Facto, The Matching Game

Through learning theory, we can begin to understand how and why different games for learning work and perhaps why some games are limited in certain learning situations. Behaviorist games, for example, have a time and place in learning. If we were to allow budding typists to play a constructivist style game where they explored the keyboard and devised their own means of typing, we’d likely end up with more two-fingered, hunt-and-peck typists. Typing correctly, with all ten fingers, requires limited instruction and extensive practice, so logically a behaviorism-derived game would be more effective in this scenario. While learning to type appears to offer a seemingly straightforward choice in approach, not all content and not all scenarios are as clear-cut. If we were to take Jonassen’s same sandlot ball players and place them in a highly structured Little League baseball practice, the learning experience might shift to a more behaviorist style with a coach giving specific commands and praise or criticism. Which situation will result in better ball players? Does it depend on the player? The coach? The goal of the activity? Each of these questions are reflective of the elements to consider when wrestling to design and implement games into learning environments. We need to find the right match. Squire

(2008) noted, “Whereas there is a saying in eLearning that ‘content is king,’ a situated view of knowledge would say that it is the context in which learners develop knowledge that is king” (p. 16). For the right context and the right learner, behaviorism can work. For the wrong context and the wrong learner, constructivism doesn't work.

Context Matters: Curriculum-Embedded Games

Whether following ADDIE, Dick and Carey, Gagne’s Nine Events, or some other established instructional design model, teachers add instructional elements purposefully. A particular field trip is chosen because it somehow connects to what the students are learning in the classroom (Noel, 2007). For example, students studying colonial America may visit Colonial Williamsburg. The field trip is an element within the curriculum and therefore has an established context and there is thus an interaction between the field trip experience and the other preceding or subsequent curriculum elements such as the text, class discussion, or project (Noel & Colopy, 2006). It is unlikely a class visits Williamsburg without any explanation as to why they are visiting nor any follow up regarding what they saw and learned (Stoddard, 2009). The field trip must serve a clear contextually relevant purpose and it must be perceived as adding value to the learning process (Noel, 2007). As games for learning become more common, I am compelled to wonder if the same considerations are being given to games as are other instructional elements such as field trips?

If the game experience is considered to be “separate” or “supplementary”, will the student struggle to integrate the game-based learning experience into the context of classroom’s traditional curriculum? Alternatively, if a teacher uses a game as a vehicle to deliberately augment the understanding of curricular content, does the traditional curriculum become stronger through the addition of game-based learning? As Klopfer and Squire (2008) argue, “...the game

experience is a function of the classroom culture and context plus the software" (p. 223). The adoption of GBL as a core part of the curriculum would be a shift from traditional instructional methods. Squire (2008) notes, "immersive eLearning is more than 'fancier window dressing for content'; it is a transformation of assumptions about what it means to think, learn, and teach," (p. 15-16). This "transformation of assumptions" that Squire (2008) refers to, however, has not been the subject of much (if any) GBL research yet it is worthy of study given the potential power of and rise of GBL in the classroom.

Curriculum and instruction often employs models to simplify, present, and scaffold complex phenomena to facilitate students' learning (Pirnay-Dummer, Ifenthaler, & Seel, 2012). The power of a curriculum-embedded game is that a successful serious game, one that is motivating and embraced by the player, can function as a pivot, bringing a model to life. A motivated learner will persist and be cognitively engaged to go beyond merely completing an assigned task and will seek to create their own meaning from the experience (Garris, Ahlers, & Driskell, 2002). If a game is "good" in that it creates the conditions for flow and a magic circle, it can generate high levels of motivation within learners, and the game is more likely to be adopted as a pivot. Once the game is adopted as pivot, meaning making and learning can occur. As we look to identify opportunities for GBL that both "fit" within an existing curriculum and add value, the area of elementary history education stands out as an area particularly ripe for improvement.

The Marginalization of History Education: Games to the Rescue?

History, as a topic for organized study, is difficult for young learners (Bransford, Brown, & Cocking, 2000). History violates childhood patterns of behavior--it is not pure imaginative

play but instead follows rules of evidence and inference, and it does not rely upon the precept of 'seeing is believing':

> If they [students] believe, for example, that we can know nothing unless we were there to see it, they will have difficulty seeing how history is possible at all. They will think that because we cannot go back in time and see what happened, historians must just be guessing or, worse, making it up" (Bransford, Brown, & Cocking, 2000, p. 31).

History education researchers have shown that young elementary students' understanding of historical time is less developed than that of adults. Dates and named periods have little relevance to their temporal awareness (Barton & Levstik, 1996; Levstik & Pappas, 1987). This doesn't mean that children cannot understand history - quite the opposite is true. Barton and Levstik's (1996) research showed that "even very young children can and do make temporal distinctions and have some knowledge of how things were different in the past" (p. 442). They go on to suggest that because children tend to relate what they see to what they already know from their everyday life, "it makes sense to place greater instructional emphasis on history that can be seen," (p. 442).

However, previous research has established that social studies instruction, and history instruction in particular, has been significantly marginalized (Fitchett & Heafner, 2010; Fitchett, Heafner, & Lambert, 2014; Pace, 2012). The emphasis on testing in American educational culture has privileged mathematics and language arts instruction. Teachers report having less time for history instruction in class and less time to prepare history lessons (Heafner & Fitchett, 2012). As a result, history instruction is often transmission-oriented, relying heavily on texts and worksheets or other at-desk activities and less on field trips and other active learning experiences. This approach, combined with children's inherent difficulties in understanding

history, has a negative effect on students' perception of history education for many students. For example, Zhao and Hoge (2005) found that elementary students viewed social studies as boring, irrelevant to their own lives, and didn't acknowledge the importance of understanding the world. Zhao and Hoge (2005) further expressed concern regarding this state of affairs, "Students need the basic knowledge and better understanding of history, geography, economics, and current issues to survive and thrive in this increasingly diverse and interdependent society" (Zhao & Hoge, 2005, p. 220).

In contrast to teacher-centric, transmissive instruction, the National Council for Social Studies (Myers et al., 2006) recommends a constructivist approach to teaching history. Game-based learning, when implemented as such, fits squarely within this charge. By immersing students into gaming "worlds" that have been created to represent historical cultures and societies, these games can encourage the higher-order thinking, systemic understandings, and meaning making that a constructivist approach encourages in a temporal framework that is understandable to children. If we also consider the specific affordances of mobile augmented reality games, the potential impact of gaming on history education is exciting.

Augmented Reality, Game-Based Learning, and History Education

If, as Barton and Levstik (1996) suggest, elementary history is better taught when it can be seen, then augmented reality offers a powerful tool to create engaging visual context for students. Augmented reality (AR) is the layering of computer-generated sensory information onto real surroundings. By adding sensory information such as audio, text, images, video, or even GPS data a basic activity can be transformed into a rich, engaging, serious game experience (Dunleavy, Dede, & Mitchell, 2009; Klopfer & Squire, 2008).

AR is not new to GBL; however, most previous research has been focused on STEM fields (see Bressler, 2014; Bressler & Bodzin, 2013; Squire & Jan, 2007; Klopfer & Squire, 2008). Squire and Jan created *Mad City Mystery* (2007), an AR environmental science game for students in 4th grade through graduate school to improve their scientific argumentation skills. Klopfer and Squire's *Environmental Detectives* (2008) is another AR, place-based game designed to help students learn about environmental science and policy. Students test soil samples to locate the source and identify the type of a toxin spill on campus and then prepare a report for University officials that describe the health risks and remediation options. Both *Mad City Mystery* and *Environmental Detectives* demonstrated that a mobile AR game could be implemented successfully and improve learning. Bressler and Bodzin similarly used AR to develop students' science process skills with their game, *The Case of the Stolen Score Sheets* (2013). In 2014, Bressler showed how students playing the AR game *School Scene Investigators: The Case of the Mystery Powder* experienced higher rates of flow and demonstrated stronger scientific practices (Bressler, 2014). In this same study, Bressler proposed defining these types of AR gaming experiences as "INPLACE" - Interdependent, Networked, Participatory Learning, Augmented, Collaborative Experience. By being mobile, these INPLACE "games can provide location-specific information and players can experience content in context" (p. 41).

While earlier research has established the value of place-based or INPLACE augmented reality games for STEM learning, I am particularly interested in the potential of these types of games to create powerful learning experiences in the subject of history. Mobile games allow students to be physically present at historical sites and AR can bring these places to life while providing historical context and meaning (Admiraal et al., 2011; Schrier, 2005). The additional information, possible flow-experience, and interactions between the learner and the history, in

situ, can deepen the experience and potentially enhance learning outcome (Dunleavy, Dede, & Mitchell, 2009; Klopfer & Squire, 2008).

After an extensive search of the literature, I located only three published studies that examined history instruction utilizing AR and GBL. All three studies focused on middle and/or high school students. Admiraal et al. (2011) studied middle and high school students playing *Frequency 1550*, a game exploring the medieval history of Amsterdam, Schrier (2005) examined high school students playing *Reliving the Revolution*, a game designed to help students learn about the American Revolution, and Gottlieb (2014) sought to examine the impact of playing *Jewish Time Jump* on Jewish education by having students explore the 1909 uprising of New York City garment workers, most of whom were Jewish. The *Frequency 1550* study found that the students learned more about medieval Amsterdam history when they encountered fewer technology issues and when they were more engaged with competitive gaming. Schrier designed *Reliving the Revolution* as an, "activity integrated into a broader history curriculum that teaches students how to approach and evaluate complex social problems" (p. 2) and found that the game enhanced students' learning of historical facts while helping them to gain an understanding of historical methodology and assume alternative perspectives. Gottlieb's (2014) *Jewish Time Jump* explored game design choices that would motivate young Jewish children who are of an age where many withdraw from Jewish education, to learn about their heritage through an engaging AR game. To the best of my knowledge, no studies have focused on AR and GBL for history education with young elementary students.

Curriculum and Assessment for Elementary Social Studies

In this age of Common Core Standards, the Race to the Top, and Every Student Succeeds Act, it is easy to adopt the idea that "curriculum" is simply a collection of learning objectives,

lesson plans, resources, and tools designed to aid teachers and students in teaching and understanding a certain set of knowledge. However, as Ross (2014) so eloquently stated in the preface of his book *The Social Studies Curriculum*:

> Curriculum is much more than subject matter knowledge—a collection of facts and generalizations from history and the social science disciplines to be passed on to students. The curriculum is what students experience. It is dynamic and inclusive of the interactions among students, teachers, subject matter, and the context. (p. xi).

In short, the whole is greater than the sum of its parts. We must understand that the curriculum is embedded into a classroom culture, it does not stand alone, and it will be enacted differently with each new class of students and by each different instructor. The planned curriculum is very often different than the enacted curriculum.

How curriculum is designed and assessed will greatly determine what levels of learning occur. One way to differentiate various levels of learning is through the use of Bloom's revised taxonomy pyramid (Krathwohl, 2002). At the base of the pyramid is "remembering" - the ability to recall facts from memory. As the learning experience becomes deeper, the student moves through "understanding", "applying", "analyzing", "evaluating", and finally, "creating". One could argue that as the learning objective targets a higher position on the pyramid, the more valuable constructivist approaches to teaching become and the more relevant to 21st century skills the learning will be (Collins, 2014). This dichotomy is also apparent when comparing traditional methods of assessments which operate under a philosophy where knowledge has a universal meaning and learning is a passive activity to alternative methods of assessments that embrace a constructivist approach to learning and meaning-making (Anderson, 1998).

Alternative methods of assessment, involving both formative and summative evaluations, provide a means by which to measure learning that extends beyond the curriculum whereas traditional assessments typically only measure learning that has happened within the curriculum (Resnick & Resnick, 1992). Standardized tests, an example of traditional assessment, are often criticized for driving curriculum and instruction. In addition to marginalizing social studies instruction, "Standards-based education reforms have [also] slowly and steadily transformed teaching from professional work into technical work, where teachers have lost control over the process and pace of their work" (Ross, Mathison, & Vinson, 2014, p. 37). The resulting enacted curriculum leaves little room for exploring topics that go beyond the curriculum that may arise during instruction and this is antithetical to recommended approaches to social studies instruction (Myers et al., 2006; Ross, Mathison, & Vinson, 2014).

Learning for retention is another aspect that needs to be considered. How much curricular content do students remember for the end-of-unit assessment and beyond? Research of retention in children has shown that over time, "episodic details disappear before semantic content and that what is recalled is an increasingly abstract or general description" (Nuthall, 2000, p. 103). The literature is also rich with studies examining how children learn, remember, and forget. There appears to be consensus about the factors that impact rates of retention. "Forgetting has been related to the degree of original learning, the type of content, the type of test item (scores on recognition items do not change as much as scores on recall items), and the ability of the students" (Nuthall, 2000, p. 84). There is also evidence to show that active learning activities and social learning can improve retention rates (Rahn & Moraga, 2007; Prince, 2004; Vygotsky, 1978). As Nuthall (2000) argued, students learn what they experience, and games provide an active learning experience. This is important because active learning, where students participate

in experiences, is often connected to deeper learning and more critical thinking (Rahn & Moraga, 2007).

Researching Curriculum-Embedded Games

While educational research has a large and growing body of game-based learning studies (see Girard, Ecalle, & Magnan, 2013), few have examined curriculum-aligned games (CAG). A curriculum-aligned game is designed to be both coherent with existing curricular content and to be an integral part of a curriculum rather than a stand-alone learning experience. Those studies that have examined curriculum-aligned games (Oltman & Hammond, 2015; Bressler, 2014) have focused solely on game-play and have not examined how the game interacted with other components of the curriculum.

While this literature is certainly helpful in understanding game-based learning, it does not truly explore the more comprehensive effect GBL can have on the whole learning experience. As Squire (2008) argued, activities such as GBL must be considered and examined within the context of the entire learning experience, the classroom, and the curriculum. With a more holistic approach, we can begin to examine questions such as how GBL impacts curricular design, classroom management, learning across the curriculum, learning beyond the curriculum, teachers' instructional and assessment practices, and even explore research design implications. It appears, however, that examining GBL within the context of an entire curriculum, or unit, has rarely been studied. In 2005, Muzzy Lane Software, an educational games company, developed a game series titled *Making History* that allowed players to simulate various historical events on a PC. While the games are designed to align with, not replace, what was already occurring in the history classroom, DeKanter (2005) did note how the classroom environment was significantly augmented by the introduction of gameplay:

> The buzz created in a classroom by a game like *Making History* is produced by the natural energy of students — and teachers — engaging each other. In a word: dialogue. It's what every teacher wants to create, and in the media-saturated culture of the 21st century, dialogue is the hardest thing to create unless you're talking the same language as the students. In this case, the language of video games becomes part of the teaching ecosystem that will, and should, continue to employ traditional tools such as textbooks, lectures, field study, standardized tests and all the rest (DeKanter, 2005, p. 29).

These observations by DeKanter (2005), particularly the suggestion that video games may create a generationally-appropriate "bridge" between teachers, students, and curriculum, certainly suggest that further study is warranted to explore how far a game's effect can extend throughout the curriculum.

If a game is implemented and studied as an integral part of the curriculum, we can begin to consider the scope and sequence of GBL and question what opportunities curriculum-*embedded* games (CEG) create in instruction (and therefore learning). The assumption is that curriculum-embedded games would perform at least as well as curriculum-aligned games, however there is scant evidence to justify such an assertion. After an exhaustive search it seems that there is practically an absence of literature examining curriculum-embedded games. There is, however, some research that examines curricula that are based almost entirely on a game (Barab, Pettyjohn, Gresalfi, Volk, & Solomou, 2012; Squire, 2010). While similar, this body of research studying game-based curriculum (GBC) is distinct from the concept of CEGs, where a game plays a central role as part of a unit that also includes other activities and instruction that are not driven by gameplay. In a game-based curriculum, the game essentially comprises the entire unit and most activities are related to the game. An example of this type of game-based

curriculum is Squire's (2010) case study in which an entire two-week unit was based around the game *Sick at South Beach*. Squire (2010) noted that this case study was "perhaps the first example of such a curriculum being integrated in classroom contexts with relatively little 'researcher intervention'" (p. 2571). The themes that emerged from the data included assertions that the gameplay story aided in creating context for students to learn and interact with the unit material, having students assume roles was important, and that the fictional context of the game encouraged students to actively engage in desired actions such as scientific thinking and writing. Barab et al. (2012) compared a game-based curriculum, *Plague: Modern Prometheus*, to a more traditional story-based curriculum and found, like Squire (2010), that the game provided students with contextualized learning along with quantitative results that showed the game-playing students outperformed the other non-gaming students in terms of learning gains.

This idea that a game provides "context" for learners aligns well with Vygotsky's pivot theory. Games, along with simulations, models, pivots, and transitional objects can operate on the same premise that the ability of learners to construct new knowledge can be scaffolded by offering new information within a context that currently fits a learner's present framework of knowing.

The GBL literature available is comprised of research that examines games as stand-alone learning tools, games that are aligned with existing curricula but that are utilized separately from the study unit, and there is even a little research on curricula that is centered entirely around a game. The gap in the existing literature, however, is that space in between - what happens when a game is embedded into an existing curriculum and is given equal weight to other unit activities?

CHAPTER 3

The Game

The Design Process

This chapter describe the origins of this study, how the game was developed, and finally how the game was implemented. Given that developing any game of reasonable quality, much less an enjoyable mobile augmented reality digital game, takes deliberate planning and a lot of time, I felt it would benefit the reader to understand fully the process from start to finish. It should be noted, however, that this is not a design study. As Boling & Smith (2009) argued, "We consider design cases to be the method of dissemination for that design research which is wholly of apiece with the act of design (as compared to design research carried out in the process of designing or research on design)," (p. 1). The game in my study was designed with the direct intention of using a DBR approach to study how games embedded into a curriculum change the learning environment. Yes, I absolutely made deliberate design choices during my study. I took a constructivist approach that drove design choices that had the intention of creating a game that was capable of producing a meaning-making opportunity for students. I did not embark on a design journey to study the design process. However, while my study isn't primarily about design, my process can perhaps provide precedent for other game designers (Boling, 2010) and thus the inclusion of this chapter makes sense to me and will hopefully provide insight for other designers and GBL scholars.

The importance of design in game-based learning cannot be understated. As noted earlier in chapter 2, Arnold, Koehler, and Greenhalgh (2016) argued that that designing for immersive experiences is a key element in maximizing the learning potential of games. If we cannot design games that invoke immersive magic circle, we lose the power of games and are left with a

learning activity that feels compulsive and mundane. More recently, a meta-analysis by Romero, Usart, and Ott (2015) found that the game mechanics inherent to serious games, such as complex collaboration, tactics, and choice, are indeed effective in advancing higher order learning. Design matters and is perhaps even particularly important for games that strive to be considered constructivist-aligned learning experiences.

I have always loved to play games whether they be physical games like soccer, analog games like *Stratego*, or digital games such as *Ingress* or *Super Mario Bros.* and so when I began my doctoral studies game-based learning seemed like a natural fit. My belief in the worthiness of game-based learning (GBL) grew as I better understood the affordances of games and how they could align with my own belief in constructivist learning (see Prensky, 2006; Steinkuehler and King, 2009). When the time came in my studies to choose a research topic, GBL rose to the top of the list and social studies appeared to be a content area ripe for exploration in this field. It also helped that my own educational background included a college minor in history and that I possessed an inherent affinity for the subject. Coincidentally, my children were attending a local private elementary school situated within a historic district that studied colonial Moravian society. In the preceding years, I had watched both of my boys experience a traditional second-grade social studies unit focusing on colonial Moravian society and remembered thinking 'there must be a better way to teach this subject'. It occurred to me that the convergence of my GBL interest, my connection with this school, the existing Moravian curriculum, and the school's physical location presented a great opportunity for a research partnership between myself and the school. Now, I just had to sell the idea to the school!

In the spring of 2014, after securing permission from the school's director, I met with the second-grade teachers to pitch my idea for this study. Understanding that a design-based

research approach would be necessary, I felt it was critical to get the teachers "on-board" with my idea. I explained how there was very little research in this area and how we could work together to explore the use of digital games with children this young together.

At this point, I did not have a game developed yet, but I did have a vision which I relayed to the teachers by showing them "movie trailer" video (https://youtu.be/9PMqhgQCg-M) designed to get them excited and concept video (https://youtu.be/8o2aRKAR6MU) designed to give them a sense of how this game might work. During our meeting, it became clear that the teachers were "all in". I had my participants! Now it was time to start designing and building a game in time to play that following fall.

In order to create a game that "felt like a real game" and one that could perhaps influence learning within and beyond the intended curriculum where players would have the opportunity to "make their own meaning" in understanding colonial Moravian society, I embraced a constructivist-informed approach (Jonassen, Peck, & Wilson, 1999; Obikwelu & Read, 2012).

To begin the game-design process, I started with the teacher-designed end-of-unit test (Appendix D) and the unit workbook the teachers had been using for years to teach the unit (Figure 1). These two artifacts would drive the core content of my game.

Table of Contents Sample Chapter Sample Activity

Figure 1. Sample Pages from Unit Workbook

I used the workbook and test to generate ideas for game quests and began to map and draw out design ideas (Figure 2). Many of the places, people, and societal norms and structures highlighted in the existing Moravian curriculum were purposefully implemented into the game design.

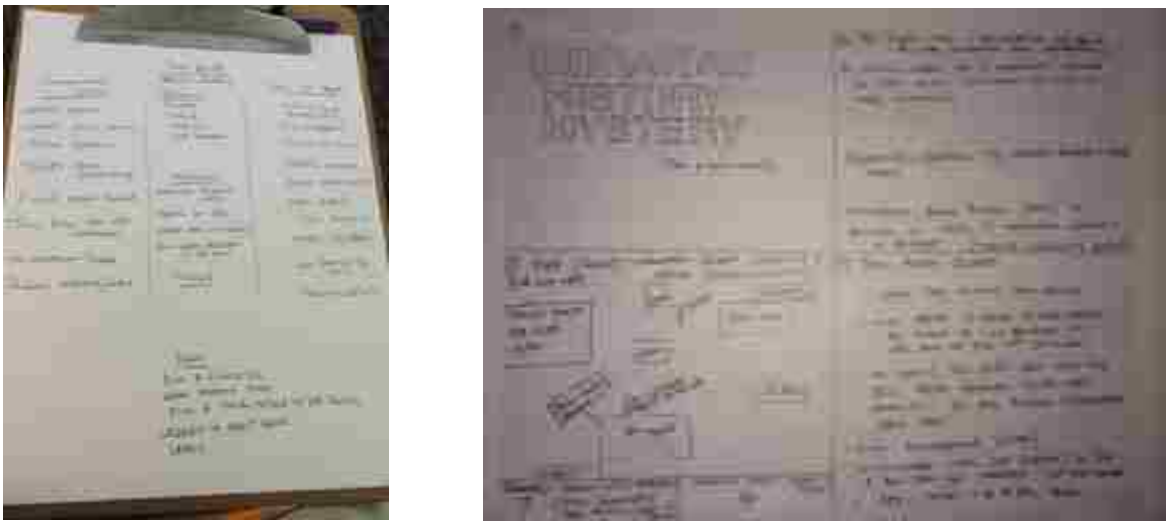

Figure 2. Samples of Early Design Documents

I also considered the geography of our intended play area, the historic district where the school was located. As shown on the map below (Figure 3), the school was surrounded by many historical landmarks that would allow students to explore the area and complete quests without having to cross busy streets, a key safety consideration emphasized by the teachers.

Figure 3. Map of School and Surrounding Historic District

The inspiration for quests and game-activities was drawn from my own experiences playing games such as *Wizard101*, *Club Penguin*, *The Lego Movie Game*, *MagiQuest*, and *Agent P's World Showcase Adventure* at Disney World, and from watching my own children, their friends, and my nieces and nephews play games. All of these games were designed for and popular with children of about the same age as I intended to study. My game format was one where teams of players would work together to complete quests in order to "level up" while navigating around a colonial Moravian society.

The "game world" I was creating was one that would reflect actual Moravian customs and societal norms. For example, many of the characters students would encounter in the game were missionaries or bishops, and many of the quests the players would be tasked with were centered around religious work. The use of religiously-affiliated characters and quests was intended to relay the idea that religious work was very important to this society without explicitly stating "this society was very religious", a sentence that would easily be skimmed over

by an eight-year-old gamer. By deliberately making design choices that aligned with a colonial Moravian society, I intended to create a game world where students could begin to formulate their own idea of what a colonial Moravian society looked like and how it worked, thus abiding by my intent to make this game a constructivist-aligned game.

Once the initial game premise had been outlined on paper, I began to formally write up each quest (Figure 4).

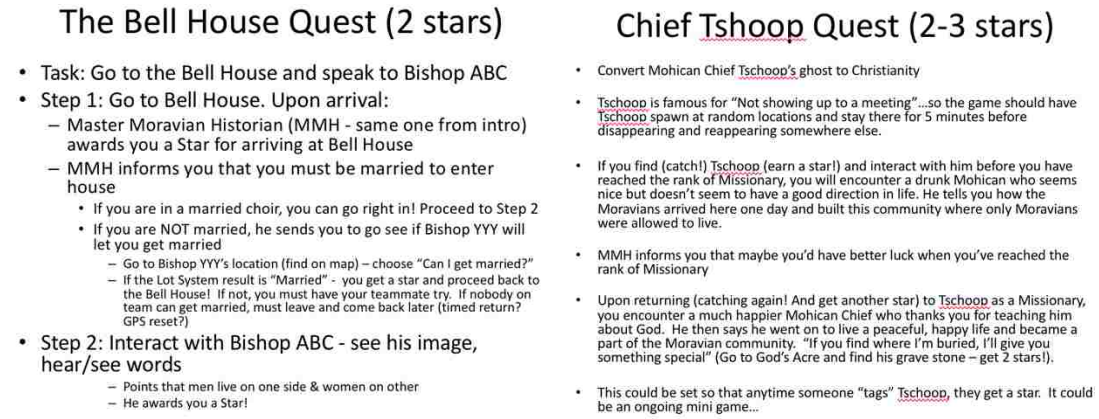

Figure 4. Sample Quest Design Documents

At this point, I believed I had a solid enough game concept that I was ready to build an actual game. Based on what I wanted the players to be able to do in the game, I drafted a list of requirements for a game-building platform (Figure 5) that included things such as augmented reality, the ability for players to save their progress, the ability to track a player's inventory, and a GPS map.

Figure 5. Sample of Game Requirements Draft

In looking for a platform on which to build my game, I considered many tools such as GameSalad, Stencyl, Xcode, and even iBook. During this exploration of different platforms, I built a functional prototype game in iBooks which helped me continue to think through the design process and solidify the functionalities I needed to make my game "work" (Figure 6).

Figure 6. Screenshot of iBook Prototype

During this time, I also attended the Games, Learning, and Society Conference (GLS) at the urging of my colleague and fellow game designer, Dr. Denise Bressler. Dr. Bressler's dissertation had also been centered around a game she had built, and she suggested I consider using ARIS (www.arisgames.org) as my game platform. During the GLS conference, I had an opportunity to meet the developers of ARIS and speak to other researchers who had used the platform, and it became clear that ARIS would satisfy my needs as a game developer for this project. ARIS would provide my game with integrated game mechanics, GPS functionality, maps, and augmented reality capabilities. The platform is also free, has a graphical interface that is simple to understand, and requires little to no coding experience. (See Figure 7.) I felt that these characteristics aligned well with the resource realities of many schools - thus providing the

possibility of expanded use within the school once our project was complete. I didn't want to build a game that could never be realistically built by a real teacher in a real school.

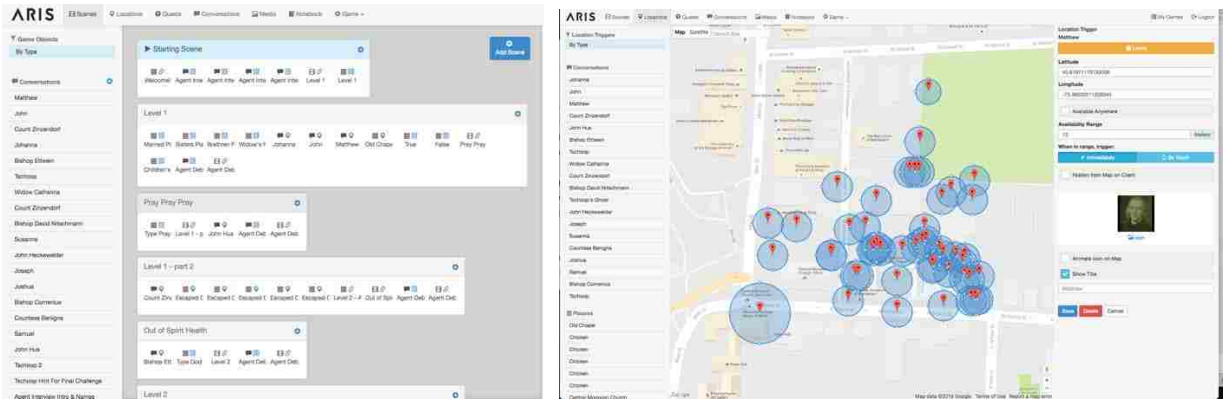

Figure 7. Screenshots of ARIS Game Development Platform

Over the course of the summer, I developed the Moravian game with ARIS using a highly iterative process. I would build, test, revise, and test again until I had a full working version 1.0 of the game. At this point, I enlisted the help of two 8-year-old boys (my son and one of the participating teacher's sons) and the participating teachers to play test the first iteration of the game (Figure 8).

Figure 8. Picture of Children Play-Testing the Game

After this first play test, I adjusted the game based on feedback I received from the testers. Soon afterwards, I had the teachers and boys play test the game again and received

additional feedback. Through this phase of build, test, play test, revise, repeat, we discovered several game-design principles that may be helpful when building games for young players:

- Introduce the game with shorter quests so that players feel like they are making progress.
- Kids want more action and less reading. Reading that is required must be both on grade level and not distracting to gameplay. If the reading is too hard or the amount of text is too much, kids will skip it.
- Curriculum content needs to be an active part of the game experience and not provided as "additional info".
- Certain tasks are intuitive for children, particularly games. Only brief instructions (if any) are required to facilitate play. The starting assumption is that the interface, etc., will require no instruction beyond introducing the central conceit of the game. Explicit direction or instruction should be added only as dictated by experience.
- Geospatial skills require significant scaffolding. Second-graders may understand what a map and compass rose are, but most have never had to navigate a satellite map before.
- Videos are not received well because they take too long. Kids want to move! They want to play the game, not stand around watching a video. Additionally, audio and video are difficult to hear and see outside.
- Certain types of gaming activities were popular and well received such as collecting items, typing codes, and figuring out the right order.

The quests and surrounding game world evolved to align with these principles and with the functionalities offered by ARIS. The game content was also adjusted to intentionally include only about half of the unit test content (Table 1) so that I would be able to compare in-game content knowledge to out-of-game content knowledge later.

Table 1

Quest List

Quest Name	Spirit Points	Description
Level 1 - Novice		
Join A Choir	-	Enter choir name into decoder to join a choir
Missing Missionary	-2	Figure out who is the missionary by asking "do you teach people about God?"
Yes or No?	-2	Rumor has it that some REALLY famous Americans have prayed at the old chapel…. we need proof that it's true or false!
Pray Pray Pray	4	
Oh dear, what year?	-2	Find Count Zinzendorf to learn what year Bethlehem got its name. He'll give you a badge, so you remember.
Escaped Chickens	-2	Pick up 5 escaped chickens quickly
Level 2 - Apprentice		
Out of Spirit Again!	6	
Name that Animal	-2	Find the church seal on the sign by the church, enter "lamb" into decoder
Grave Concerns	-2	Find Tschoop's Christian name on his gravestone, enter "John" into the decoder
First House	-2	View Hotel Bethlehem, Enter GREEN into decoder to view the First House
Time to Pray!	4	Visit Count Zinzendorf - code word 1741
Level 3 - Adept		
Collect the Keys	-2	Collect the keys to the places of worship in the order the buildings were built (Saal, Old Chapel, Central Church)
Missing Records	-2	Go visit John Heckwelder - he'll send you to the Nain house (where Indians live) - to collect the records of all Mohicans the Moravian missionaries have converted to Christianity
Go Pray!	6	See Joseph - Pray - Unitas is the magic word
Find a Ribbon	-2	We need a blue ribbon! You need to find the right house!
Schnitz Scurry!	-2	Pick up 5 apples and bring them to the Schnitz house - get some Schnitz to take as a snack
Level 4 - Expert		
Benigna Began?	-2	Find Countess Benigna, ask what she started, Enter word "school" into the decoder
Unitas Fratrum! Pray Again!	6	Go see Joshua - Pray - Fratrum is the magic word
Firewood Frenzy	-2	There is a blizzard coming! We need firewood - everyone helps! Go collect 5 sticks!

Doctor Dash!	-2	Visit the Apothecary to get some medicine for a sick friend
Level 5 - Master		
Collect your Master's Badge!	-	Go to the flag pole to receive your Master's Badge! - need to type in Unitas Fratrum to prove you're worthy!

Throughout the entire design and implementation process, the teachers provided valuable insights that guided my process resulting in a game we all felt was ready for deployment with the upcoming fall's second grade.

The Game for Year One

In the game Moravian History Mystery, players are told that all of the adults have caught a virus that has wiped their memories of all colonial Moravian knowledge. The players are "recruited" to become "history agents" who can help rediscover all of the missing information. Their goal is to level up by completing quests with the ultimate goal of reaching the final level of "Master Historian". The kids are "on their own" because none of the adults remember anything that will help them complete the quests. The adult chaperones who do accompany the players outside are only good for keeping them safe as they traverse the historic district. They cannot help play the game, because they know nothing, which many children found funny.

In an effort to generate a true gaming experience, one that felt like a "real game" and would likely generate a magic circle, curricular content was intentionally included in the game not as "additional information" but as content critical to the player's advancement within the game. For example, an important construct that the teachers wanted the students to understand was that the colonial Moravians were a very spiritual community, often praying many times per day. In many role-playing games, players have "health". Lose enough health during game play, you die and have to start over or "respawn" at an earlier checkpoint. In the Moravian game we

developed, players have a similar attribute called “spirit health”. During gameplay, the players lose spirit health over time (See Table 1 above). Once they eventually have zero spirit health, they must go pray to replenish their spirit health (see Figure 9). Praying is accomplished by entering the requisite “prayer word” (often a key Moravian vocabulary word, such as *Unitas Fratrum*) into the game’s decoder. The game requires players to repeat this process several times, to the point where most players often express exasperation at how many times they have to go pray! Our intention was that this familiar game mechanic and repeating experience would ultimately lead to a conversation and deeper understanding of the community’s spirituality thus aligning well with a constructivist approach to learning.

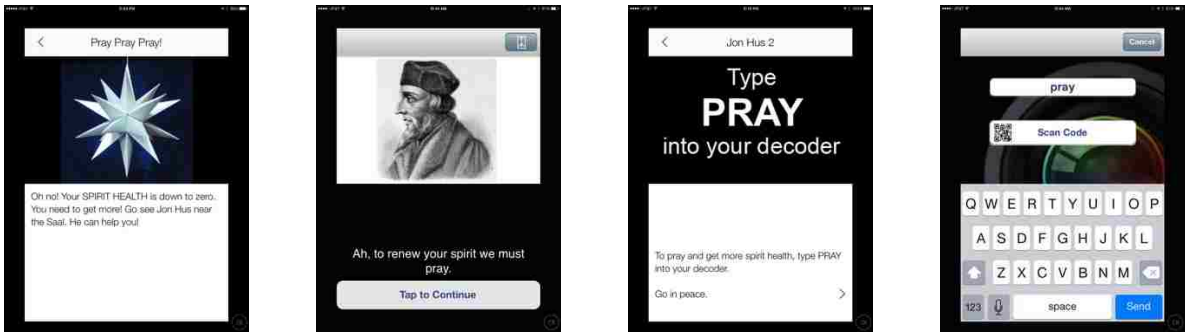

Figure 9. Example Prayer Quest

ARIS allowed us to give the players several “tools” for gameplay such as a quest list where they could see their progress, a satellite map where they could see their own location and that of game elements, a decoder where they could type in codes, an inventory where they could track the items they collected, a scanner where they could scan QR codes, and finally a “player” tool where they could see their character’s level (Figure 10).

Figure 10. Screenshots of Game, Version 1

In accordance with DBR practices, the game continued to be tweaked over the full duration of the study with adjustments being made to language and quest difficulty to continually improve the game experience for the players. For example, when it became clear that many students were getting errors typing in the code “pray” because they were typing in all capital letters, I changed the text they saw in the game from “PRAY” to “pray”. In another example, after the first two classes continued to have difficulty locating Tschoop’s gravestone during one quest, a game character’s dialogue was adjusted to provide a more obvious location clue resulting in class three experiencing less frustration with that particular quest. These modest adjustments allowed the player experience to improve over time and are consistent with a core purpose of DBR to discover “what works” in an authentic environment.

The Game for Year Two

For year two, slight modifications were made to the game’s design for two reasons. First, ARIS had upgraded its platform to version 2.0 and this version included a significantly different, and in my opinion better, player interface. Even if I hadn’t felt the upgrade was an improvement, I had to upgrade simply because the new ARIS application would not render our version 1.0 game properly. Tools had been simplified in ARIS 2.0 and moved off the bottom of the player’s

screen and into a menu, the list of quests acquired a much more graphical appearance, and overall the game was given a more modern and “clean” look (Figure 11).

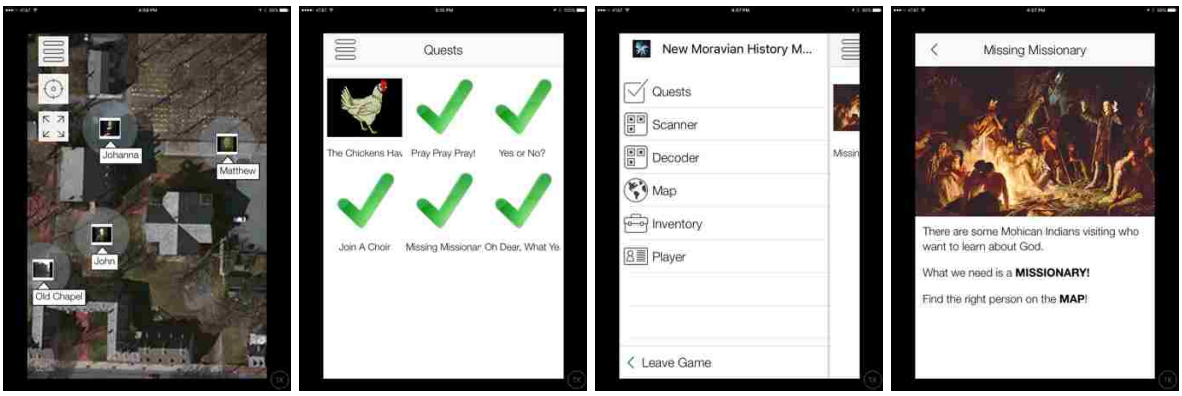

Figure 11. Screenshots of Game, Version 2

The second design change, a stealth pre and post-game agent interview, was implemented to meet the study’s need to try to isolate and capture learning that occurred during gameplay. In an effort to preserve a magic-circle, I framed these two interviews within the story of the game, thus rendering them “stealth” assessments (Figure 12). During the game’s introduction, I told students that we needed to confirm that their memories had not been affected by the history virus that was plaguing adults, so we had to interview them before they started playing the game. Teams were handed a special agent envelop that contained a series of QR codes. When the students scanned a code, they would be presented with a question such as “Name 3 ways colonial Moravian life was different that your life today”. Students would use the game’s built in microphone found in the “Notes” tool to record their answers. Once they had been affirmed as qualified agents, they would play the game as just as the previous year’s students had. When it was time to stop playing, each team’s chaperone would hand them a “Debrief” package of QR codes that asked the same questions as the pre-game interview. The premise for this debrief was that agents are always “debriefed” after secret missions so we can see what they have achieved.

Figure 12. Images and Screenshots of Stealth Assessment

These stealth assessments blended well into the game experience thus preserving the magic circle for the players while providing me the opportunity to collect important data.

Game Implementation

The intervention implemented in year one was designed as a feasibility study to determine if this type of GBL could be successfully utilized at the early elementary level as no previous research had established this possibility. Once feasibility was established and learning gains were demonstrated, the year two implementation was specifically designed to study the effects of embedding a GBL experience within the curriculum. The year two participating teachers were consistent across both years of the study, teaching the same curriculum using the same methods: workbook, field trips, craft activities, and the augmented reality game.

At the beginning of every initial play session across both years, I assessed the students' attitudes towards games and game-based learning (see Appendix A), utilizing items adapted from Bonanno and Kommers (2008). (Development of this instrument is further described later in Chapter 4.) Results affirmed that these students were indeed typical of their generation of

young learners as generally having positive relationships with games and being immersed in a media-rich, technology infused, and gaming culture (Oblinger, 2004; Prensky, 2006). This finding does not suggest that this population can necessarily be generalized to all second graders; however, it does establish that, at least in their attitudes and beliefs towards digital games and learning, that these students are not atypical.

In the first year, the game days followed the timeline outlined in Figure 13.

Step	Activity
1	Researcher and adult chaperones arrive in the classroom
2	Researcher tells students the game's backstory (history virus)
3	Teacher announces teams and chaperones; students pair up
4	Researcher hands out iPads
5	Researcher gives brief overview of game tools while projecting game on Smart Board
6	Researcher leads class through the first quest together in the classroom
7	Teams are released to continue playing the game on their own outside
8	Teams play the game for a predetermine amount of time
9	Team chaperone collects the iPad and administers the flow questionnaire
10	Students return to classroom
11	Teacher leads a full class debrief session

Figure 13. Game Day Timeline for Year One

Year two's game implementation was essentially a replication of year one's game implementation with one significant addition - the stealth interview and debrief activity (Appendix G), which was added to allow for closer scrutiny of embedding a game into curriculum. These interviews occurred before step 6 and after step 8 of the original game day timeline.

For every gameplay session, students were grouped by their respective teacher into teams of dyads and triads with one iPad distributed to each team. An adult chaperone was assigned to each team to ensure the safety of students as they navigated across the historic campus and to aid with any technical or sharing issues that may arise. Students were asked to take turns holding the iPad to be the "reader" at each location and holding the iPad while being the "navigator" moving

between stops. The rationale for having teams of students sharing a single iPad was two-fold. The primary reason being that gaming, as well as learning, tends to be a social activity (Bandura, 1971; Inal & Cagiltay, 2007). The second reason was one of simple practicality as the number of iPads and adult chaperones available was limited. While ARIS does allow for the development of games that do not require a constant Internet connection, the game I built required an Internet connection and thus required iPads with a cellular data plan since we would be outside, away from any available Wi-Fi network. The school's iPads were all Wi-Fi-only, so I supplied iPads that could connect to the Internet using a cellular connection.

After a brief introduction in the classroom (which included the stealth pre-game interview in year two), the teams ventured outside to continue gameplay sessions that varied between 40-60 minutes for each session. The time allotted to each play session was dependent upon the time available in that particular day's schedule. At a predesignated time, play was stopped in the field and each team's chaperone oversaw the completion of the stealth debrief (year 2 only) and a flow survey by the students (See Appendix B). The flow survey was given in the field to capture the students' psychological state during their gaming experience as accurately as possible. iPads were collected from the students and a play-session debrief, led by the students' teacher, was conducted immediately afterwards in the classroom. Teachers were given a suggested list of questions by me to use for the debrief (Appendix G), however, the teachers were encouraged to take the conversation in whatever direction they felt was appropriate. Occasionally, I would be invited to contribute to the class debrief. All debrief sessions were audio-recorded by me. I also kept observational notes throughout the gameplay sessions.

Across both years, a design-based research approach was taken due to the novelty of this experiment and the need to rapidly adjust factors in the field to respond to classroom, teacher,

and student needs. For example, once it became clear that the first class in year one struggled with geospatial orientation (matching the satellite image to their immediate surroundings), a visual introduction was added for the second and third classes that gave a demonstration of map-reading and orientation. Positive adjustments such as this one, made in the field during year one, were carried over into the second year's implementation from the outset lending to a more consistent gameplay experience between the two second year classes.

CHAPTER 4

Methodology

Introduction

This chapter will describe the methodology used to study the following research questions:

1) In a second-grade history unit, what are student experiences playing a curriculum-embedded game?
2) In a second-grade history unit, what effect does curriculum-embedded gameplay have on…
    a) students' learning & retention of curriculum-specified content?
    b) students' learning & retention of concepts beyond those specified in the curriculum?
3) In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

Considering that the study of curricular-embedded games is an emerging field and that the research questions propose both an implied proposition (RQ2 - effect of CEG on learning outcomes) as well as descriptive inquiries (RQ1 – student experiences while playing a CEG and RQ3 - effect of CEG on instructional planning and implementation), a mixed-methods approach for collecting data was deemed appropriate. This study is also classified as an uncontrolled quasi-experiment (Shadish, Cook, & Campbell, 2002). Students were not randomly selected or assigned to groups, there was no control group (all students participated), and the setting was a real-world elementary school which inherently presents uncontrollable variables into the study. The study was conducted under these conditions for two principal reasons. First, the teachers requested that all students participate in the study, so all students would have an equal opportunity to learn from anything I introduced into the unit. Secondly, I wanted to study the effects of a curriculum-embedded game on an authentic classroom environment. Therefore, no

effort was made to control the natural setting of teachers, students, and materials beyond what was logistically necessary to run the experimental, game-based portion of the students' instruction.

Given this desire to study CEGs in an authentic environment and to create a game that fit within the existing classroom culture, A design-based research approach (DBR) was employed (Barab, 2014). DBR is appropriate for developing innovative instruction or applying technologies where no or little previous work has been done (Barab & Squire, 2004). A mobile digital AR learning game is a novel instructional strategy for early elementary students; no "best practices" for implementation or design have been established. In 2008, Klopfer and Squire utilized a similar approach in their "environmental detectives" study; however, no other published research has applied this strategy to an early elementary environment. Because a primary purpose of this study is to consider factors for a successful real-world implementation, DBR's rapid adjustments to design and implementation in the field was critical. A more thorough discussion of the ways in which this study's implementation conformed to DBR will follow after a description of the data collection and analysis procedures.

Data Collection

At the end of the unit, students were given a teacher-designed test. Once the tests had been graded by the teachers and flow scores had been calculated, I used purposeful sampling to select 3-6 students from each class for a semi-structured interview. Purposeful sampling, where just a few participants are selected for their potential to provide data relevant to the topic being studied, is a well-established technique for qualitative data collection when the researcher wishes to explore a phenomenon or experience in-depth (Patton, 2002). Upon consultation with the teachers, students that would be well equipped to provide information-rich interviews and that

also represented the range of test scores and gameplay experiences were selected. These interviews were audio-recorded. Teacher interviews were also conducted just prior to game-play, post-game play, pretest, and posttest.

The gameplay implementation described in chapter 2 was consistent between year one and year two, however, for year two, additional mixed data sources were tapped to expand the study and address the new research questions regarding curriculum embedded GBL. Year two data collection included everything in year one plus the addition of 2 field trip observations, 29 classroom observations, a teacher-designed pre-test, a pre and post gameplay stealth assessment, and the collection of student unit work samples such as drawings, writings, map activities, and photography. Unlike the first year where I was only present in the classroom for play sessions and interviews, in year two, I was regularly present in the classroom from the very beginning of the unit in mid-October until the conclusion of the unit in early February. In both year one and year two, the instructional pace, timing of "chapters", and all non-game related activities were planned and implemented at the teachers' discretion. The decision of when to "play the game" was also driven by the teachers' preferences. A full timeline of the project is displayed in Table 2.

Table 2
Project Timeline

Timing	Activity
Spring 2014	Secured participation of school and teachers
Summer 2014	Developed game, version 1.0
October 2014	IRB approval obtained
	Consent obtained from parents and teachers
	Final walk through with teachers
	Purchase and setup of iPads
	Recruitment of game day chaperones
November 2014	Game attitudes questionnaires administered
	Gameplay sessions
	Flow surveys administered
	Class debrief sessions
December 2014	Teacher interview 1 – post-game
March 2015	Teacher interview 2 – post-unit
April 2015	Student interviews
May 2015	Secured participation of school and teachers for year 2
Summer 2015	Developed game, version 2.0
October 2015	IRB continuation approved
	Teacher interview 3 – pre-unit
	Field trip observation
	Before game classroom observations
November 2015	Field Trip observation
	Before game classroom observations
	Teacher interview 4 – pre-game
December 2015	Game attitudes questionnaires administered
	Pregame stealth interview
	Gameplay sessions
	Postgame stealth debriefs
	Flow surveys administered
	Class debrief sessions
	Post-game classroom observations
	Teacher interview 5 – post-game
January 2016	Post-game classroom observations
	Teacher interview 6 – pre-test
February 2016	Post-game classroom observations
	Unit Posttest
	Teacher interview 7 – post-unit
	Student Interviews
March 2018	Member check

Analysis Procedures

I used data from both years to address all three research questions. The analysis of data was as follows:

- Quantitative analysis:
    - Using data from year one and two, descriptive statistics of flow data.
    - Using year one data posttest data, measures of variance comparing game-related test items to non-game-related items.
    - Using year two data, pre and post repeated measures of variance comparing game-related test items to non-game-related items.
- Qualitative analysis
    - Interviews were transcribed and coded using grounded theory techniques. Initial coding was guided by themes and codes identified during the year one study. Year two data was matched against this year one framework while simultaneously incorporating emerging codes. This process is explained more thoroughly later in this chapter in the section discussing qualitative data.
    - Field observations were conducted with me acting as an "observer as participant" (Patton, 2002). These observation notes were coded using the same methodology as was used for the student and teacher interviews.
    - Samples of student work were also coded per my observations using the same methodology as the observations and interviews.
    - The pre- and post-game stealth assessment audio recordings were transcribed and analyzed using the same methodology.

Setting, Participants, and Context

To explore the application of curriculum-embedded game-based learning to elementary history education, I worked with second grade teachers and their students over the course of two years at a private urban elementary school located in eastern Pennsylvania that is comprised primarily of higher income families. The teachers and I worked to develop, implement, and refine an AR game to run on iPads that sought to enhance the established curricular unit focusing on colonial Moravian history. The school was selected due to a convergence of my own research interest in game-based learning, history education, and my familiarity with the school's curriculum as a parent of enrolled students. As I began to look for opportunities to explore game-based learning, this particular school emerged as a willing partner that offered a convenient yet unique research opportunity due to my existing relationship with the school, its location in a colonial Moravian[2] historic district, and because a study unit focusing on colonial Moravians has been a part of the established second grade curriculum for many years. During the first year of the study, there were three classes and three teachers; during the second year there were two classes and two teachers. The reduction in the number of classes was simply due to variation in the school's grade-level cohorts; the first year had a larger-than-average cohort, requiring three classroom teachers. The second year reverted to the more typical pattern of two classes per grade level. Two teachers were active participants for the full two years and the third teacher was only involved for the first year. Each of the teachers involved in the study had over ten years of teaching experience and can be considered "veteran" teachers having also taught for

[2] Colonial Moravians immigrated to America in the early 1700's from eastern Europe to escape religious persecution. In 1741, they established the town of Bethlehem, PA. In 1742, they established the school in this study. The Moravian Church, a protestant religious group, still exists today and is still affiliated with the school in this study.

at least one other school besides the one in this study. All three are Caucasian females with their ages ranging from mid-30's to early 60's. They also had varying degrees of comfort using instructional technologies and had no notable previous experience using game-based learning for history education. Students ranged in age from 6-8, with 36 students participating in year one and 22 in year two. The class sizes ranged from 10-13 students. Only one student over the course of the two years fully declined to participate in the study and one student did not provide me with a copy of their posttest, leaving the total sample size, across all 5 classrooms, at 58. There were 32 male and 26 female students over the two years. While the majority of students were of Caucasian descent (26 of 36 in year 1 and 15 of 22 in year 2), there were a notable number of students identifying as other ethnicities: 4 as Hispanic or Latino, 1 as African American, 2 as Asian, 2 as South Asian/Indian, 1 as Middle Eastern, and 5 as multiple ethnicities. 2 students chose not to disclose their ethnicities. English was the home language for all students in this study. The researcher also did not observe, nor was made aware of, any special accommodations for any student during this study that would indicate any significant learning differences or disabilities for individual students. While income data was not available, it can be reasonably assumed that the strong majority of students come from socio-economically advantaged families as the tuition required to attend this church-affiliated private school is substantial at more than $20,000 per student, per year. An informal survey completed by the parents also affirmed the assumption that these students had easy access to, and were highly familiar with, devices such as iPads, computers, and game consoles at home.

The differences in implementation and data collection across the two years are shown in Table 3, below. The analysis procedures to be followed with this data are summarized in Table 4. The following section will describe the instruments and analysis procedures in detail.

Table 3

Data Sources Mapped to Research Questions

Data/Timing/Population		Year 1			Year 2	
		Class 1	Class 2	Class 3	Class 1	Class 2
Unit Test	Pre	Did not collect data			Q2	Q2
	Post	Q2	Q2	Q2	Q2	Q2
Gameplay	Pre	Did not collect data			Q2	Q2
	Post	Did not collect data			Q2	Q2
	Flow Survey	Q1	Q1	Q1	Q1	Q1
	Class Debrief	Q1 Q2 Q3	Q1 Q2 Q3	Q1 Q2 Q3	Q1 Q2 Q3	Q1 Q2 Q3
Observations	Pre-game	Did not collect data			Q2 Q3	Q2 Q3
	Game	Q1	Q1	Q1	Q1	Q1
	Post-game	Did not collect data			Q1 Q2 Q3	Q1 Q2 Q3
Teacher Interviews		Q2 Q3	Q2 Q3	Q2 Q3	Q2 Q3	Q2 Q3
Student Interviews		Q1 Q2	Q1 Q2	Q1 Q2	Q1 Q2	Q1 Q2
Artifacts of Student Work		Did not collect data			Q2 Q3	Q1 Q3

Table 4

Research Questions Mapped to Measures and Analysis

RQ	Measures/Data Source	Analysis Procedure
2	Pre-Unit Test	Paired-samples t-test
2	Post Unit Test	
1	Flow Survey	Descriptive statistics
2 & 3	Teacher Interviews	Structured coding (a priori) of game experience using flow and magic circle themes Structured (a priori) coding of learning, using curriculum Emergent coding of instructional strategies, following constant-comparative technique
1 & 2	Student Interviews	
1, 2, 3	Class Debrief Sessions	
1	Gameplay Observation Notes	
2 & 3	Field Trip Observations	
1, 2, 3	Classroom Observations	
2	"Agent Interview & Debrief"	
2 & 3	Artifacts of Student Work	

Instruments to Describe the Population

Game Attitudes Questionnaire. A game attitudes questionnaire (GAQ) was used to assess students' attitudes toward gaming in both educational and recreational environments. The final instrument (see Appendix A) consisted of 4 Likert-type items that were modified from original scales (Bonanno & Kommers, 2008) in a manner like Bressler and Bodzin (2013). The participating teachers and an early literacy expert assisted in calibrating the language and presentation of the instrument to a level deemed appropriate for a typical 2nd grade student. Demographic information such as gender, age, and ethnicity, was also collected at the same time

as administering this instrument. The final instrument had a Cronbach's alpha of .86 in the year one study.

Instruments to Qualify the Experience

Flow questionnaire (year 1 and 2). Previous research has established both the mediating relationship between flow and learning (Bressler, 2014; Brom et al., 2014; Hamari et al., 2016; Hou, 2015) and the potential for flow experiences during gameplay (Sherry, 2004). This study's first year data suggest that these findings can be extended to children as young as six or seven. Therefore, to identify positive gameplay experiences, and thus optimal learning opportunities, among year two students, flow was again measured during the second-year study. A Likert-type survey (see Appendix B) was developed by modifying an existing scale (Bressler, 2014) by consulting the participating teachers and an early literacy expert to calibrate the reading level and comprehension of a typical 2nd grade student to that of the instrument. The language of the original instrument was simplified, and text prompts were replaced by emoji-style icons. The resulting survey consisted of 11 items and had a Cronbach's alpha of .88. This reliability was slightly higher than our source (Bressler, 2014; Bressler & Bodzin, 2013), who reported alphas ranging from .77 to .80.

Assessments to Observe Learning Outcomes

Unit pretest (year 2 only). At the beginning of the unit, the students' prior knowledge about Colonial Moravians was measured using a teacher-designed pretest (See Appendix C). The test consisted of 20 fill-in-the-blank questions requiring 21 answers that could be sourced from a supplied word bank (a list of possible answers that students use to answer the accompanying test questions) at the top of the test paper. The teachers' felt that using the word bank would be less discouraging to students, as the teachers believed that the students knew very little about the unit

content. This assessment primarily measured fact-recall and could thus be characterized as an assessment of the first level of Bloom's revised taxonomy, "remember" (Krathwohl, 2002).

Unit posttest (year 1 and 2)

The end-of-unit assessment tool was a unit test also designed by the teachers (See Appendix D). This test, or a slightly modified version of this test, has been used for this unit for several years. The assessment consisted of 22 "fill in the blank" questions but did not include a word bank like the pretest. For example, students were asked to "List two reasons the Moravians came to America," and "Colonial Moravians did not live as families. Instead, they lived in groups called [fill in the blank]." Like the pretest, this posttest also that primarily measured fact-recall and could thus be characterized as an assessment of the first level of Bloom's revised taxonomy, "remember" (Krathwohl, 2002). The Year 1 posttest had a reliability of .89, as measured by Cronbach's alpha.

Limitations of the Unit Pre and Posttest. The pre and posttest had two significant limitations. First, as is typical with most young elementary assessments, the teachers designed both the pre and posttests with the goal of testing basic knowledge that they expected students to be able to recall, and hence the teachers expected most students to do very well. This produced a ceiling effect (see Figure 15, in Ch. 5). To address this effect, I decided to select and analyze cases that fell below the mean for each test. Admittedly, this decision gave us significantly fewer cases to analyze in each case but by doing so any differences between game and non-game items would be more apparent. The second limitation of the instruments was that they were not identical. The pretest was purposely given a "word bank" as described above simply because the teachers did not want the children to feel like they were "failures". This is reasonable considering how young these students were. The two tests also did not include identical question-sets. This

limited our comparison to the 6 game-related items and the 6 non-game-related items that did match across the two instruments. The steps I took to account for these limitations is further described in the following chapter, results.

This closed-ended assessment was supplemented by a map activity. Students were given a satellite image of the community area (see Appendix E). This map was blank save for named streets and a couple of named landmarks. The students were asked to draw and name as many Colonial Moravian buildings and places they could remember and to label the displayed compass rose. While the content covered between the pretest and posttest was very similar, no word bank was provided for the posttest and no map was included with the pretest.

The teachers' assessment provided a content template for my development of the iPad game. The teachers wanted every 2nd grade student to play the game and hence there was not an opportunity in this study to have a control group. Therefore, to compare game and non-game learning, about half of the unit content covered by the posttest was included in the game while the remaining posttest content was purposely excluded. This resulted in two subscales comprising of game-related items (n=11) and non-game-related items (n=11) which were further reduced to 6 and 6 for reasons described above. Game-related items were either introduced or reinforced during gameplay. For example, one test item prompts students to list the colonial Moravians' three original houses of worship and to provide the correct sequence in which they were constructed. This concept was integrated into gameplay as students were required to collect keys to each house of worship in the order in which the houses were built to complete the quest "Collect the Keys" (see Figure 14). If they visited a house out of sequence, they would not be able to pick up the keys and were told to come back later. The three houses of worship were all within physical sight of each other and if students noticed the size difference, they could

decipher that the correct order was smaller to larger as the congregation built new houses over time as their community grew in number. The puzzle could also, admittedly, be solved through trial and error as well however the game offered players the opportunity to use higher-ordered thinking to complete the quest more efficiently. Either way, in order to advance in the game, the students had to physically visit the three houses in the correct order. In contrast, the non-game-related items were only addressed during traditional instruction, outside of gameplay.

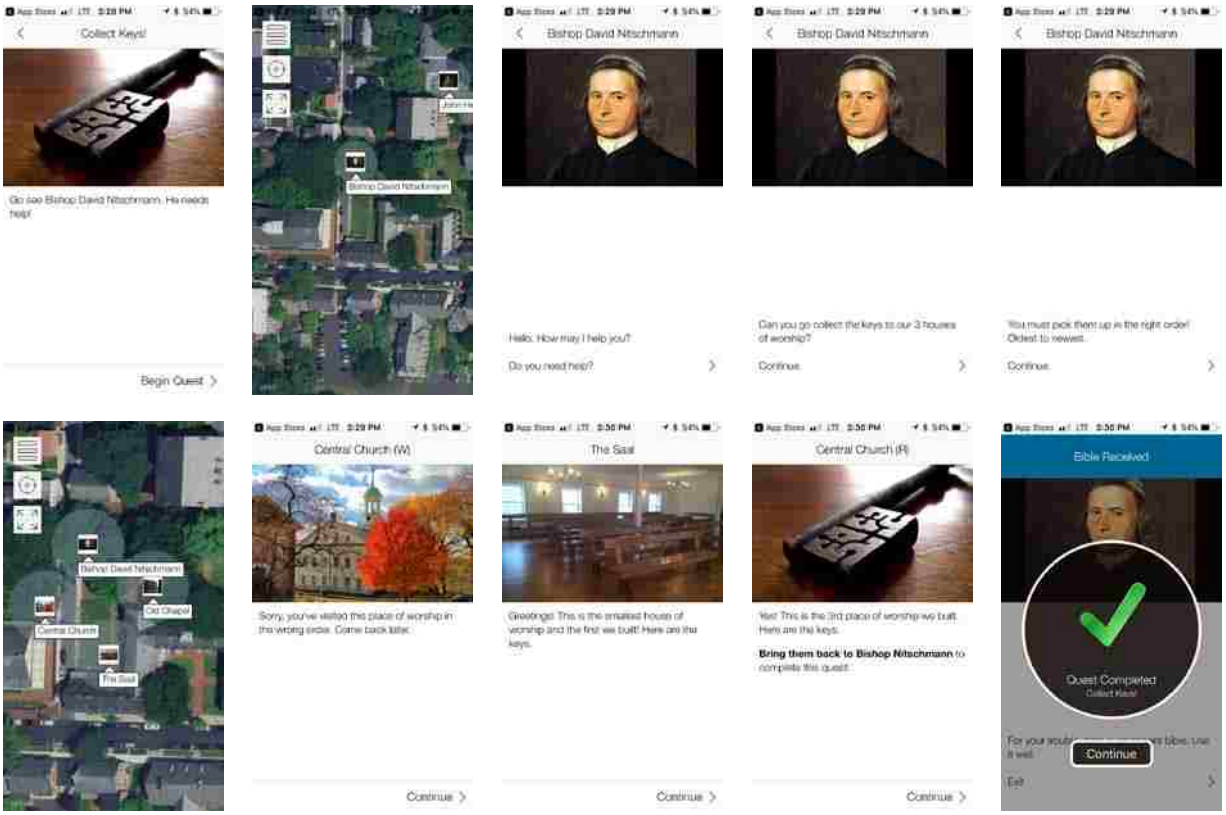

Figure 14. Sample Quest: Missing Keys

Qualitative Data Sources

To provide both a deeper view of learning and context on the learner experience, the research design included multiple qualitative data sources. In year one and year two I conducted semi-structured interviews of the teachers (Appendix H) at various points during the unit and of purposefully selected students (Appendix F) at the conclusion of the unit each year. The

selection of students was intended to represent the range of test scores and gaming experiences. Each of these interviews was audio-recorded and later transcribed. Classroom debrief sessions (Appendix G) conducted after each gameplay session were also audio-recorded and later transcribed.

Over the course of the entire curricular unit in year two, I also observed traditional instruction for both classes a total of 29 times, accompanied the classes on two unit field trips, and photographed various artifacts representative of student work completed during the unit. During all the observations, I took written field notes.

To explore any learning occurring during gameplay in year two, a pre- and post-gameplay "stealth" assessment (Appendix I) was incorporated into the students' gaming experience. At the start of the game, students assumed the role of "history agent" and were asked to participate in an "agent interview" so that we could verify that their "historical memories" were intact. Students then proceeded to scan their secret codes (QR codes) with the game's built-in scanner to trigger a brief series of three questions. Student then recorded their answers using the game's built-in microphone feature. After gameplay the second day, students/agents were handed a "secret agent debrief" packet of QR codes that led them through the same series of questions again. These recordings were later captured and transcribed by me.

Qualitative Data Coding. As noted in table 4, I used a combination of a priori and emergent codes (See Appendix J) to analyze the qualitative data (Stuckey, 2015). The decision to use pre-determined (a priori) codes to analyze research questions 1 and 2 was based on my intent to examine the gameplay experience (RQ1) and learning (RQ2) through specific construct lenses. As discussed in chapter 2, magic circle and flow are valid constructs by which to examine a gamer/students' playing experience. Hence, the a priori codes for RQ1 were based on the tenets

of magic circle and flow. Data were coded as to whether or not it reflected a state of flow or acceptance of a magic circle. As also mentioned in chapter 2, there is often a difference between the intended curriculum and the enacted curriculum. Research question 2 is focused on determining if a curriculum-embedding game has an effect on learning within intended curriculum and beyond the intended curriculum and thus, codes to examine RQ2 were developed using a categorization of learning that is described in the next section of this chapter (mastery, exposure, and beyond the curriculum learning). For research question 3, however, I did not have any previously identified constructs by which to establish a priori codes and so all coding was emergent. A list of codes for each research question is provided in Appendix J.

Categorizing Levels of Learning

As research question 2 address learning that is both part of the intended curriculum and learning that occurs beyond the intended curriculum, I created three "levels" of content to reflect the teachers' intended learning outcomes: 1) "Mastery" content is defined as content that either is on the posttest or could be on the posttest. It is information that the teachers plan to present during instruction and expect the students to fully understand and remember. 2) "Exposure" content is defined as content that is part of the intended curriculum but that students are not necessarily expected to remember and would never be on the test. 3) "Beyond" content is learning that exceeds the intended curriculum but that is connected to the unit. It is learning that the teacher never intended to occur and is not a planned part of instruction. As RQ2 also specifically focuses on the effects of an embedded game on learning, I categorized each data example in accordance to its proximity to gameplay: "before" being data collected before gameplay, "close" being data collected immediately following gameplay, "medium" being data

collected during the unit but more than a day after gameplay, and “far” being data collected after the unit had concluded. Examples of this coding are detailed in the following table.

Table 5

Table of Sample Statements and Codes for Learning Statements

Learning	Proximity	Statement	Rationale
Mastery			Statement directly point to a posttest question:
	Before	They had different houses for different people. (OB1H - S - 38)[3]	Q10 - Colonial Moravians did not live together as families. Instead, they lived in groups called [blank]
	Close	Saal, Old Chapel, and the Central Moravian Church (BCD2 - S25 - 122, 124)	Q9 - List in order the 3 places where the Moravians worshiped.
	Medium	[asked to define Missionary] Someone doing religious work (OB9H - S - 42)	Q4 - The Moravians were called [Missionaries] because they taught others about God.
	Far	I remember when it said, "Who found Bethlehem?" And I remember it's David Nitchman. (SI57 - S57 - 88)	Q5 Who was the founder of Bethlehem?
Exposure	Before	[Zinzendorf] paid for ships so they could go to Africa, north america, and Greenland. (OB2H - S - 86)	Zinzendorf is an important name, but this fact about him is a detail students would not be expected to recall.
	Close	I liked when I found Tschoop and found out that his real like his Moravian name was John. (BCD1 - S18 - 39)	Tschoop is part of the curriculum but students wouldn’t be expected to recall his Christian name.

[3] Citation of qualitative data goes as follows: (setting, speaker if known, line in transcript).

	Medium	Asked why Moravians learned German] Because when everyone was done at being a...person that teaches about God...missionary! They have to go back and they don't want to forget their language. (OB13T - S - 43)	Moravians' work as missionaries is part of the curriculum but students wouldn't be expected to recall why the Moravians learned German.
	Far	We got to see the Nain house and I didn't know about the Nain house before. (SI43 - S43 - 62)	The Nain House is mentioned in the curriculum but it is not a major landmark and is not on the list of buildings students are expected to recall.
Beyond	Before	They didn't have electricity. They used yokes to get water.They had longer school time than we do now. They did not invent SMART boards. They did not have iPads. They did not have water fountains. (PRG1 - TH1 - 1)	This is a detailed comparison of how colonial Moravian life is different than modern life using student-generated examples and not ones provided by the curriculum.
	Close	I learned that Martha Washington prayed in the Old Chapel...George Washington's wife I think. And so did John Quincy Adams and his father, John Adams. (TCD1 - S31 - 115)	These historical figures were not part of the intended curriculum but the information was available to students during game play.
	Medium	[No examples recorded]	[No examples recorded]
	Far	I liked how we got to use the iPad, how there was a big map and we got to read the map and it would show us where widow's house, the Brethren's house, the sister's house, ect. (SI43 - S43 - 38)	Reading and understanding how to use a GPS map was not part of the intended curriculum but was a necessary part of gameplay.

Significance of the Study

In order to explore how GBL can, and perhaps already is, changing the learning environments of our classrooms, it is important to drive the field toward more substantial lines of inquiry beyond simple learning-outcome studies that focus on fact recall and to aid in grounding our field within accepted learning theory. While it was important in year one to establish that well designed games for learning do indeed work, it is now important to explore and understand what the implications are on our students and teachers and on learning and teaching. This study will be significant in several ways: 1) This study extends GBL / serious games (SG) work in social studies. As noted in Chapter 2, there is little research being done with serious games and social studies. 2) This study introduces GBL / SG work into second grade, a previously unrepresented population in GBL research. 3) This study takes a much deeper look at learning than most GBL studies by asking if the students are not just meeting the curriculum but exceeding. The study also combines quantitative and qualitative measures of learning while including modest controls by looking across in-game and non-game content. 4) This study takes a much deeper look at the instructional importance of GBL by looking at not just the game but the curriculum surrounding the game, particularly as teachers adapt their teaching to take advantage of the game. 5) Finally, this study provides a cohesive theoretical framework for the role of the game as an instructional element: As learning employs models, the game can embody the model. The model therefore becomes a pivot, empowering the game affordances of intrinsic motivation, experimentation, and social learning.

Ethical Considerations

Education researchers must keep in mind the primary purpose of school is to educate its students and not to provide research opportunities for doctoral students or other scholars. If a partnership is developed between a researcher and a school, it must be nurtured wisely to ensure that the primary objective of the schools is not sacrificed in the pursuit of data. Researchers have an ethical obligation to put the student and teacher first in all considerations.

In early 2014, I initially approached the school director (principal) to discuss the possibility of conducting research with the second grade. I had an existing relationship with the director as both of my children attended the school at the time although both had already completed second grade. After a positive conversation about my goals and idea for the study, permission was obtained from the director to approach the second-grade teachers to propose a partnership. I shared my research questions, an outline of the initial game storyboard, a proposed timeline for game implementation, as well as a "movie trailer" with the teachers to help describe my idea and vision for the game. While I made it clear that nobody was required to participate and anyone could withdraw at any point, the teachers were all excited to participate and all participated fully in the study. Since the teachers expressed a desire to have every student "play the game" and in an effort to abide by the principle that every child should have every opportunity to learn, I designed the study such that all children could play and participate.

At that point, a study proposal was submitted to and approved by the Institutional Review Board of Lehigh University [668573-2]. An approved informed consent form was distributed to all parents. No teacher, child, or parent was required to participate. One child/parent in year one and one child/parent in year two did decline to participate in the study and while they still "played the game" and joined in class debrief sessions in order to participate in the full class

activity, none of their data was not collected or recorded by me. All children/parents that originally consented to participate in the study completed the study.

I took particular care to work within the constraints of the typical school day as to not interfere with the primary goals of the school and teacher. Recognizing that time is a highly valuable commodity in a school, gameplay sessions were designed to fit within the time allotted by the teachers and classroom observations and interviews were scheduled with the teachers' consent and pre-approval. I made every effort to work around the teacher's and school's schedules.

In an effort to ensure privacy, all data was secured at my home or in an encrypted online environment accessible only by myself and all identifiers were stripped from all data prior to analysis.

Limitations & Threats to Validity

As this study employs a mixed-methods and design-based approach in the field of educational research, there are several considerations that must be taken regarding limitations and validity. In their discussion regarding DBR, Barab and Squire (2004) remind us that:

> ...simply observing learning and cognition as they naturally occur in the world is not adequate given that learning scientists frequently have transformative agendas. Education is an applied field, and learning scientists bring agendas to their work, seeking to produce specific results such as engaging students in the making of science, creating online communities for professional development, or creating history classrooms that confront students preexisting beliefs about race, gender, or class. (pp. 1-2)

DBR studies, such as this one, attempt to make claims based on the very intervention the researcher introduces, in this case GBL, and thus great care must be taken to ensure the

credibility and trustworthiness of the study and its conclusions (Barab & Squire, 2004). “Our goal, as applied researchers engaged in doing design work, is to directly impact practice while advancing theory that will be of use to others,” (Barab & Squire, 2004, p. 8). By acknowledging our limitations and possible threats to validity, any claims or conclusions I make can be appropriately considered within their own constraints.

It should be noted, however, that when considering the qualitative component of this study that many qualitative scholars reject the notion of validity entirely as comparing results to a “real world” is impossible since we all have different perceptions and interpretations of our surroundings and may generate different meanings from similar circumstances (Maxwell, 2013). It also fair to argue that eliminating the influence of the researcher in a qualitative study is simply impossible (Maxwell, 2013). However, for the purposes of this study, I embrace Maxwell’s (2013) idea that considering how correct or credible a description, conclusion, explanation, interpretation, or other sort of account is relative to the world around us is a worthwhile endeavor and one that lends value to such extrapolations.

Threats to Validity. Relevant threats to internal validity of this study include (Creswell, 2012):

- History: Student exposure to the curricular topic, Moravian history, was not isolated to the curricular unit. The school was founded by Moravians and thus, Moravian traditions, stories, and history are all interwoven into many aspects of daily school life. Thus, it is possible, even likely, that some learning occurred outside of the unit. I was aware of much of this extra-curricular content as my own children were students at the same school and will consider such additional exposure during the analysis, comparing the events of year 1 and year 2.

- Maturation: This study took place over two years with each cohort participating in the unit from mid-October through late March of their respective year. In the life of a second-grader, this constitutes an extended period of time. Thus, the maturation level of the students studied and their familiarity with me may have been significantly different from the first time I met the students to when I conducted my final interviews with them. The timing of each year's experience (history instruction, assessment, interviews) was similar, but I will consider this evolution when examining the data.
- Selection: Selection bias is possible, as students were pre-assigned to different classes and game-play groups within classes by the teachers. While any socially-derived effects are uncontrolled, I did conduct purposeful sampling for interviews (by gender, by test scores, and by flow scores) was conducted within each class, minimizing the bias introduced by any one grouping.
- This study did not have a control group and thus it was not possible to compare results of our intervention with a non-intervention group. Strategies to minimize this threat included a pretest in year 2, a pre/post gameplay stealth assessment, and having posttest that consisted of half game-related and half non-game-related content.

Relevant threats to external validity (or generalization) (Creswell, 2012) include:

- Interaction of selection and treatment: The participants in this study are private school students who are mostly from families of relatively high socioeconomic status. It is difficult to suggest that any conclusions made by this study could be replicated with students from different backgrounds.

- Interaction of setting and treatment: This study was conducted at an expensive small private urban elementary school in Pennsylvania. Results may not be similar at public schools, large schools with larger classes, or rural schools.
- Interaction of history and treatment: This study was conducted during the fall and winter of each year. Similar studies conducted later in the school year or for varying durations may yield different results.

Threats Specific to Qualitative Analysis

Qualitative data presents its own set of challenges that could lead to incorrect conclusions. Erickson (1986) identifies five types of major evidentiary inadequacy associated with qualitative data collection: 1. Inadequate amounts of evidence, 2. Inadequate variety in kinds of evidence, 3. Faulty interpretive status of evidence, 4. Inadequate disconfirming evidence, and 5. Inadequate discrepant case analysis. This study endeavors to minimize these potential inadequacies through the employment of several strategies identified by Maxwell (2013):

- Intensive, long-term involvement: In year two, I visited and observed each classroom over 29 separate times, conducted multiple interviews with the teachers over the course of the study, and spent several days with the classes overseeing gameplay, debrief sessions (Appendix G), and student interviews (Appendix F). By sustaining a regular presence in the classroom, I was able to achieve saturation, collect a wide variety of data, and was able to check and confirm inferences, observations, and understandings of classroom culture.

- Rich data: Long term involvement with and observation of the participants combined with in-depth interviews of both students and teachers has generated a trove of rich data that is both varied and detailed. Conclusions drawn from rich data are well grounded.
- Triangulation: By sourcing data from a variety of sources including interviews, observations, assessments, and artifacts, I attempted to minimize the systemic biases or chance associations due to any one specific data source.
- Numbers: Similar to triangulation, the adoption of a mixed methods approach by collecting quantitative data allows the reinforcement and validation of conclusions drawn from qualitative data.
- Member checks: Once preliminary findings had been identified, I shared these findings, along with evidentiary evidence, with the participating teachers and solicited robust feedback, encouraging them to "poke holes" in the findings and present counter-evidence if they felt their experiences were represented inaccurately.

Researcher as Instrument

In purely quantitative, controlled experiments, the participants in a study have very little to no interaction with the researcher and thus the impact of the researcher on the data is, at least in theory, very minimal (Patton, 2002). Qualitative research, however, is fundamentally different. In collecting qualitative data such as interviews or observations, the researcher often is the "instrument" collecting the data (Patton, 2002). Thus, as Maxwell (2013) suggests, the "researcher as instrument" should be cognizant of two broad categories of threats when conducting qualitative research: researcher bias and reactivity, or the effect the researcher has on the study participants. It is impossible to eliminate researcher bias as we all bring our own set of beliefs, theories, and experiences. Nor is it possible to fully eliminate all influence of the

researcher on the participants (Maxwell, 2013). However, we can strive to maintain a high level of integrity by explaining freely our potential biases by disclosing our relative history, experience, and notions and being cognizant of this background when analyzing our data (Maxwell, 2013; Patton, 2002).

My mother was a high school English teacher for over 30 years and greatly influenced my views on education and teaching. She holds three master's degrees (English, Teaching, and Special Education) and is an independent soul who always sought what was in the best interests of the student with little regard for the administration or prescribed curriculum. When teaching "low-level" sophomores who struggled to read, she went out and bought Mad magazines, Sports Illustrated, and any sort of graphic novel she thought would "hook" them on reading. If a kid didn't like what they were reading, they wouldn't read. As a student's reading level improved, they would naturally seek out more sophisticated novels, books, magazines. She always felt that if a student wasn't learning, it wasn't the student's fault; she had to find a better way. She ultimately shared her philosophy regarding teaching and learning through several published books on the subject. Fundamental to her approach, and one that I've adopted in my own beliefs, is that every child is a natural learner and that we as educators must adapt to the child. We must be learner-centered.

My father is a retired U.S. Navy Captain who holds two master's degrees and finished his career working in the computer industry. Hence, our family enjoyed traveling and was certainly an "early adopter" when it came to personal computing and technology. My mother bought the very first edition of the Apple laptop and my father gave me one of the very first personal laser printers produced for my college graduation, which I am proud to say lasted over twenty years. (They don't build them like they used to!) I grew up in a family where education and learning are

highly valued. With five advanced degrees between my two parents the prospect of earning a doctorate never really seemed out of reach. I acknowledge my privilege.

I majored in English with a minor in History and played collegiate soccer at the University of New Hampshire. I had thoughts of becoming an English teacher like my mother but ultimately ended up pursuing a career in soccer coaching instead. In my mind, I was teaching. My classroom, however, was a soccer field and I was teaching a game. Thus, in essence, my first career was facilitating game-based learning.

In an effort to improve my skills as a coach, I completed several coaching education courses offered by both the United States Soccer Federation and the National Soccer Coaches Association of America, ultimately earning the highest licenses awarded by each organization (USSF: "A" and NSCAA: "Premier"). I believe I was actually one of the very first women to earn the Premier License. Through the course of my formal coaching education, a phrase commonly professed by our instructors was "the game is best teacher". Soccer is a game where decisions must be made in the flow of the game. There are no time-outs. A player must learn to make tactical and technical choices without the input of a coach and the only way to practice and develop that decision making is to play in a truly game-like environment. To paraphrase Sid Meier, the creator of the game Civilization: soccer is a series of interesting choices.

While coaching collegiate soccer, I earned my Master's Degree from UNH in kinesiology with a specialization in sports psychology studying theories of motivation and strategies to enable peak performance in athletes. My coaching career also included working with US Soccer's Youth Olympic Development Program at both the state and regional level. I also spent many summers working at soccer camps for children of all ages. After about 11 years of collegiate coaching, I changed careers and became a collegiate athletics administrator. However,

I have spent countless hours teaching the "beautiful game" (as soccer is known throughout the world), and continue to do so in a limited capacity as my own children's club soccer coach.

My entry into athletic administration pushed me to develop an understanding of how a full athletic department works from facility management to risk management to budget management. Along the way, I became known as the "department techie" since I had an affinity for technology. Eventually, this led to my current position as the Assistant Athletic Director for Technology. In 2010, I decided that earning a master's degree in Instructional Technology would be beneficial for my professional development, however, about two classes shy of graduating, my advisor at the time convinced me that switching to the doctoral program was a good idea. (Little did I know….)

My husband and I have two wonderfully curious sons and I am lucky in that we both believe that a good education is one of the best gifts a parent can provide for their child. In that light, we made the decision to send our boys to private school, the same one in fact, where this study was conducted. We strongly believe in the mission and philosophy of the school and feel privileged to be able to send our children to a school that is not drowning in predetermined mandates and standardized testing. Our family is part of the school community. I recognize that the educational experience of my children, and the children in this study, is not a representative experience for most children in our country or around the world for that matter.

Along with my family, professional, and educational background, my personal interests have also helped shape my perspective of the world. I am avid reader, *Star Wars* fan, skier, soccer player/coach/fan, and gamer. The first video game I remember playing was *Pong* and I remember playing *The Colossal Cave Adventure* for hours on my father's PC. I grew up playing Atari with *Pitfall*, *Missile Command*, and *Space Invaders* making my own hall of fame. I

remember hoarding quarters to play arcade games such as *Gauntlet* and *Pac-Man* in the local bowling alley and fighting with my brother over who could use the Game Boy. These days, I can be found playing the MMORPG game of *Wizard101* or the augmented reality games Ingress and *Pokemon Go!*. We also currently own a WiiU, PS4, Nintendo Switch, and XBox One, and my boys certainly keep me abreast of the latest and greatest console games.

When considering my own experiences and history, I am aware that I approach educational research with inherent biases. I believe instruction should be learner-centered and I am a believer in constructivist theory. I believe technology, when implemented wisely, can be tremendously beneficial to the teacher and the student. I also believe that students can learn from well designed, well implemented games. While I will endeavor to be as open-minded when analyzing data, it is impossible for any researcher to entirely remove the lens by which they view world. The best we can do is attempt to recognize where our own biases may be in play and acknowledge that influence.

Additionally, I realize that while my regular presence in the classroom over the course of several months and my interactions with teachers for well over two years has allowed me to gain a fuller understanding of classroom culture and garner a rich set of data, it has also increased the odds that I have had an influence on the participants of the study, both students and teachers. I am now known around the school as the “game lady”. While I made every effort to appear impartial and open to any idea and opinion, it must be acknowledged that with added familiarity, often comes an added desire of the study participants to please the researcher. I am not sure this is entirely unavoidable, but I will make every effort to minimize such reactivity by finding multiple supporting threads of evidence when identifying themes and proposing conclusions.

CHAPTER 5

Results

This study explored the use of a curriculum-embedded mobile augmented reality game within a second-grade history unit. As noted in chapter 2, there is a dearth of research examining game-based learning (GBL) within an early elementary social studies unit. This study provided an opportunity to explore GBL's relationship with learning and teacher pedagogical practices in this under-studied setting using a mixed-methods, design-based research approach.

For this setting, I provided an augmented reality, mobile iPad game designed specifically for the colonial Moravian history unit of a small urban private elementary school in eastern Pennsylvania. Over the course of two years, I observed and studied five different classes of students (n=58) experience this unit and curriculum-embedded game. From the multitude of observations, interviews, teacher-designed assessments, flow scores, and student-produced artifacts, a trove of data was collected to explore the following questions:

1. In a second-grade history unit, what are student experiences playing a curriculum-embedded game?
2. In a second-grade history unit, what effect does curriculum-embedded gameplay have on…
    a. students' learning & retention of curriculum-specified content?
    b. students' learning & retention of concepts beyond those specified in the curriculum?
3. In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

This chapter will present the results and findings that emerged from the collected data to address each of the questions listed above and explain the analytical process that was employed.

Findings for Research Question 1

Finding 1. The first finding addresses research question 1: In a second-grade history unit, what are student experiences playing a curriculum-embedded game? This study found that the students in this study experienced the game as a "real game", finding it enjoyable, immersive, and worthy of play. This finding is supported by three datasets: flow scores, student interviews (Appendix F), and observations from classroom debriefs sessions (Appendix G) that occurred immediately after gameplay.

Flow scores by class (Table 6) show that every class had a mean flow score greater than 4.2 (of a possible 5) thus indicating that nearly all students experienced high rates of flow while playing the game. Class 2 has the highest SD, but it is still fairly low at 1.06.

Table 6
Flow by Class

Class	Year	Teacher	N	M	SD
1	1	T1	13	4.36	.35
2	1	T2	13	4.23	1.06
3	1	T3	11	4.67	.38
4	2	T1	9	4.28	.62
5	2	T3	12	4.42	.59
Total			58	4.39	.66

Note: The range of possible mean scores was 1-5. The mode mean score was 4.6

In an effort to explore any possible differences by teacher, I examined flow scores by teacher (Table 7). Results indicate that every teacher had students with mean flow scores greater than 4.2. T2 had the highest SD at 1.06 which aligns with the fact she was the teacher for class 2.

This data shows that students were likely to experience flow while playing the game regardless of who they had for a teacher.

Table 7

Flow by Teacher

Teacher	N	M	SD
T1	22	4.33	.46
T2	13	4.23	1.06
T3	23	4.54	.51
Total	58	4.39	.66

In an effort to explain the higher SD of class 2, an examination of individual flow scores for class 2 (Table 8) was conducted. As this table shows, class 2 had one student (S17) with an average flow score of 1. Qualitative data shows this student had a poor partner experience thus explaining this student's self-reported low flow score. "I didn't like our team's sportsmanship. We were yelling at other" (CDB2 - S17 - 53). This student's individual flow score accounts for the larger SD for this particular class and suggests that partner experience may be important in determining a player's overall experience and enjoyment.

Table 8

Class 2 Flow Scores by Student

Student ID	N	M	SD
14	-	4.00	.
15	-	4.18	.
16	-	3.91	.
17	-	1.00	.
18	-	5.00	.

19	-	4.91	.
20	-	5.00	.
21	-	4.64	.
22	-	4.27	.
23	-	4.27	.
24	-	5.00	.
25	-	4.00	.
26	-	4.82	.
Total	13	4.23	1.06

Analysis of the qualitative data associated with players' experiences (student interviews and observations of post-gameplay classroom debriefs) was conducted through a lens of flow and magic circle. I identified statements that indicated if a student was in or out of flow and in or out of the magic circle. Representative samples of the coding process are presented in Table 9.

Table 9

Flow and Magic Circle Qualitative Data Samples

Theme	Definition	Data
In Flow & In Magic Circle	Student statement indicates an in-flow experience and the adoption of the game's magic circle	I loved it the way it is and nothing should change about it because it was perfect. It was like best game that I ever played outside in my life. (CDT2 - S54 - 42) Something that really stuck in my head is that the Hotel Bethlehem used to be where her First House was and she really wanted to see it again so when we typed something...green..it it made me feel so happy that we helped her. (CDB1 - S - 51) I don't know...I really felt like I was not [learning], but I knew I was learning somehow because I never knew there was a person [such] as Tschoop. (SI56 - S56 - 28) When I get to run around, it's easier to actually learn because you don't really know that you're learning it. You just think you're playing a fun game. (SI44 - S44 - 32)
In Magic Circle	Student statement indicates adoption of the game's magic circle	I liked how we got to use the iPad, how there was a big map and we got to read the map and it would show us where widow's house, the Brethren's house, the sister's house, ect. (SI43 - S43 - 38) My favorite part was when we had to find the three buildings and get the keys and give them to the guy. (CDH2 - S - 16)
Not in Flow	Student statement indicates they did not experience flow	I got a little frustrated when some of the teammates wouldn't let you see the iPad or let you know what you're doing 'cause then you can't really help them if they're doing something wrong. (CDB2 - S20 - 60)

		I think because S18 was my partner it was hard because we were like splitting up and it was really hard. (CDT1 - S37 - 138) It was hard. (SI28 - S28 - 6)
Not in Magic Circle	Student statement indicates a rejection of the game's magic circle	The thing is, it did not really make that much sense when there's a man, who's name was John like me, and he was living on the middle of the road. Living on the middle of the sidewalk. I thought that was a little bit weird. (SI56 - S56 - 12) I felt that all of my teammates were getting in my space and I couldn't really focus. (CDT2 - S - 133)

The prevalence of indicators and subgroups is identified in Table 10.

Table 10

Prevalence of "In Flow" and "In Magic Circle" Indicators in Student Statements

Theme	Subgroup	Number of statements
In Flow & In Magic Circle	Being active	2
	Embracing challenge	6
	Enjoyment while playing	49
	Excitement	5
	Feeling confident	2
	Feeling curious	1
	Feeling like a real game	5
	Feeling need to run	1
	Focused while playing	2
	Game feeling real	20
	Game was medium difficulty	6
	In zone	2
	Liking being outside	2
	Liking game elements	2
	Losing sense of time	2
	Liking map	2
	Wanting to play again	2
In Magic Circle	Enjoying being active	10
	Enjoying searching	3
	Enjoying playing	8
	Feeling excitement	1
	Game feeling real	5
	Importance of difficulty	1
	Liking game elements	22
	Liking partner play	2
	Liking map	12
	Sense of accomplishment	2
	Wanting to play again	20
Not In Magic Circle	Interactions with partners	1
	Map was hard	2
	Game not feeling real	1
Not In Flow	Playing difficulties	2
	Interactions with partners	10
	Challenge was hard	5

In both the individual interviews and the group classroom debriefs, there were many statements providing supporting evidence for the assertion that these students were both in flow and inside the magic circle while playing the game thus supporting finding 1. To further parse out if there was a difference between reporting in an individual setting (interviews), which occurred 4-5 months after gameplay, and in a group setting (class debriefs) which occurred immediately after gameplay, a further analysis was done to review and compare these data separately (Table 11 and Table 12).

Table 11

Prevalence of "In Flow" and "In Magic Circle" Indicators in Student Statements During Game Debriefs

	Only Flow	In Magic Circle	Not In Magic Circle
In Flow	0	58	0
Not in Flow	8	15	1
Only Magic Circle	N/A	41	0

Note: Because classroom debriefs were group discussions, it was impossible to capture every statement or to identify every speaker, therefore it is impossible to determine how many students made statements in each of these categories and hence only the quantity of statements was recorded.

Table 12

Prevalence of "In Flow" and "In Magic Circle" Indicators in Student Statements During Interviews

	Only Flow statements (students)	In Magic Circle statements (students)	Not in Magic Circle statements (students)
In Flow	0	60 (17/18)	0
Not In Flow	9 (5/18)	7 (6/18)	3 (2/18)
Only Magic Circle	N/A	44 (17/18)	0

In both the group setting and the individual setting, the data presents strong evidence that students playing the game both entered the magic circle and likely experienced flow, thereby affirming finding 1. In both settings, the majority of statements relating to flow and magic circle indicated an "in flow" experience and an adoption of the game's magic circle. While there were twice as many "not in flow" statements in the group setting compared to the individual setting, the number is still relatively small (15) when compared to the "in flow" statements of both settings and can likely be explained by the proximity of the statements to the actual gameplay experience. These students were talking about their experience immediately after gameplay and if they had experienced a "flow blocking" experience, the frustration was still probably fresh in their minds whereas that frustration had probably faded by the time students were interviewed individually months later. The second most prevalent type of statement were ones that simply indicated an adoption of the magic circle.

Findings for Research Question 2 – Part A

Finding 2. The second finding addresses research Question 2, part A: In a second-grade history unit, what effect does curriculum-embedded gameplay have on students' learning & retention of curriculum-specified content? The second finding is that there are inconclusive indicators of a game-effect on curriculum-specified learning for the students in this study.

Analysis strategy. As noted in the previous chapter, the teacher-designed test presented two significant limitations in that posttest scores were subject to a ceiling effect (See Figure 15) and in that the pre- and posttest items were not identical. In an effort to account for these limitations, I employed two strategies. To address the posttest ceiling effect, I not only analyzed the full sample of scores during the posttest analysis, but I also narrowed the sample of scores to those that occurred below mean. Secondly, for all of the statistical tests in this section, I only

compared test items that matched between the two instruments (see Table 13, below). The series of paired samples tests I conducted are described below.

Posttest game and non-game items comparison. In this first analysis, I conducted paired samples t-tests to determine whether students performed significantly differently on game and non-game items on the post-test. Students from year 1 and year 2 were included in this analysis.

As noted above, the pre and posttests featured some differences in items and wording. (See Appendices C and D.) After discounting the unmatched questions, the final pool of items for analysis included 12 matched questions. These questions appeared on both the pre- and posttest, albeit with slightly different wording. Of the 12, 6 were game-related questions and 6 non-game-related questions. Table 13 (below) details the selection and categorization of the 12 items.

Table 13

Matched Pretest and Posttest Questions

Game Related?	Pretest Question	Posttest Question
non-game	From what 2 countries did the Moravians come?	In which countries did the Moravians originally live?
game	Who gave Bethlehem its name?	Who gave Bethlehem its name?
game	When was Bethlehem named?	When was Bethlehem named?
non-game	Where did the single men live?	Where did the single brothers live?
non-game	Where did the widows live?	Where did the widows live?
game	Where did the single women live?	Where did the single sisters live?
game	Where did the married couples live?	Where did the married couples live?
game	The Moravians divided themselves into groups called....?	Colonial Moravians did not live together as families. Instead, they lived in groups called [fill in blank].
game	The Moravian cemetery is called?	[fill in blank] is the Moravian cemetery.

non-game	This is celebrated 4 weeks before Christmas	The 4 weeks before Christmas are called the season of [fill in blank]
non-game	This is the scene that tells the Christmas story	The Moravians decorate their homes and churches with a [putz] to tell the story of Christmas.
non-game	The church service in which the Moravians share buns and coffee together is called a ....?	The song service in which food such as cookies and juice are served is called a [fill in blank].

After testing for assumptions, I found that a paired samples t-test for the full sample of 58 students was not valid as the two sub-scales (game and non-game items) are statistically correlated (see Table 14).

Table 14

Correlation of Matched Game-related and Non-game-related Items

		N	Correlation	Sig.
Pair 1	Matched Game-Related Matched Non-Game Related	58	.75	.000

As noted in chapter 4, the unit posttest assessment was limited due to a ceiling effect – for example, 18 out of the 22 students in Year 2 scored a perfect 12 out of 12 on the matched items in the posttest (see Figure 15).

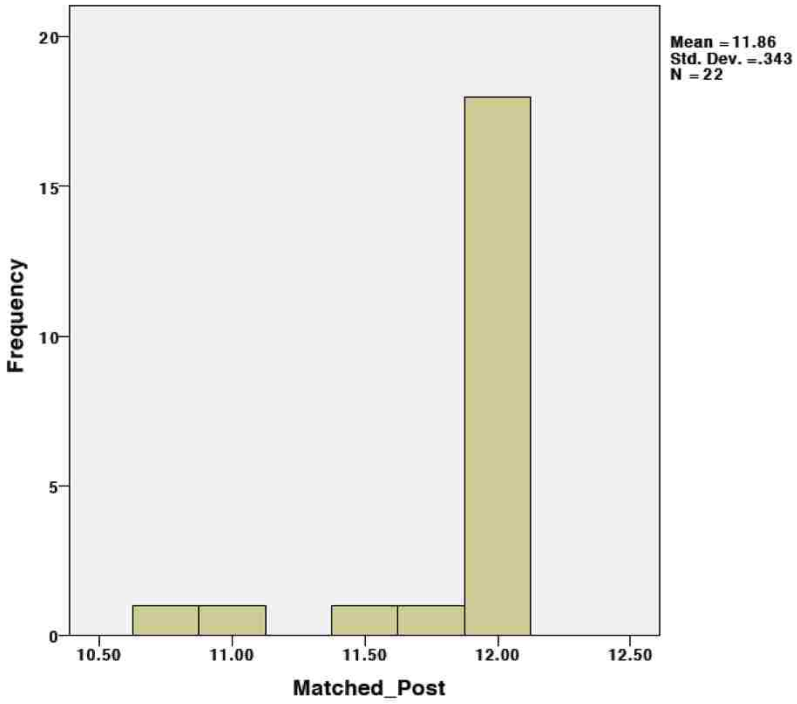

Figure 15. Histogram of Matched Posttest Scores

This ceiling effect was a result of both the aims and means of this particular set of teachers and curricular unit. The teachers in this study were teaching for mastery with the expectation that every student could achieve a very high score on their posttest. This expectation was verified through member checks. Furthermore, the test items are at a low level of Bloom's taxonomy, stressing fact-recall, and many students indeed scored very well on the posttest, with a mean score of 10.85 out of a possible 12 (Table 15).

Table 15

Descriptive Statistics for all Matched Posttest Cases

	N	Min	Max	M	SD
Matched Post	58	3.50	12.00	10.85	2.04

Note: Because of multi-part questions, partial credit is possible, hence the minimum score of 3.5 out of 12.

Because of this ceiling effect, an additional analysis of the posttest scores was limited only to those students (n=15) scoring below the matched questions posttest mean of 10.85. This selection resulted in a group of 15 students, drawn from both Years 1 and 2. Their performance on the six game-related and six non-game-related items are described on Table 16, below.

Table 16

Descriptive Statistics for Matched Posttest Cases below the Mean

	N	Min	Max	M	SD
Matched Game Related	15	2.50	6.00	4.38	.84
Matched Non-Game Related	15	1.00	6.00	3.53	1.64

After verifying all assumptions were met, a paired samples t-test was run to determine whether there was a difference between matched posttest game-related scores and matched posttest non-game-related scores (Table 17) for the 15 students that scored below the posttest mean.

Table 17

Paired Samples Test Comparing Game and Non-Game Matched Posttest Scores

		Paired Differences							
					95% Confidence Interval of the Difference				
		M	SD	SE of M	Lower	Upper	T	df	Sig (2-tailed)
Pair 1	Matched Posttest Game-Related Matched Posttest Non-Game-Related	.85	1.60	.41	-.03	1.73	2.06	14	.058

Table 17 shows that there was no statistical difference game-related and non-game related scores for students who scored below the mean suggesting there was no game-effect on the posttest

scores. This result, however, must be considered within the context of a low sample size and is therefore considered inconclusive.

Pretest to posttest comparison. Next, I conducted a series of paired sample t-tests to compare matched pretest scores to posttest scores. Only students from year 2 (n=22) were used for this analysis as year 1 students did not take the pretest.

The first paired samples t-test was a full sample analysis. Descriptive statistics are shown in table 18.

Table 18

Descriptive Statistics for All Matched Pre and Posttest Cases

	N	Min	Max	M	SD
Matched Pretest	22	0.00	11.00	5.30	2.82
Matched Posttest	22	10.75	12.00	11.86	.34

Note: The maximum possible score was 12. Partial credit was given in some cases as questions had multiple parts.

After verifying that assumptions were met, a paired samples t-test was run (see table 19).

Table 19

Paired Samples Test for Matched Pre and Posttest Game and Non-Game Items for All Students

		Paired Differences							
					95% Confidence Interval of the Difference				
		M	SD	SE of M	Lower	Upper	t	df	Sig (2-tailed)
Pair 1	Matched Pretest Matched Posttest	-6.57	2.81	.60	-7.82	-5.32	-10.95	21	.000

Results in the above table (19) show there was a significant difference between the matched pretest scores (M=5.30, SD=2.82) and the matched posttest scores (M=11.86, SD=.34);

t(21)=-10.95, p=.000. This shows that student scores improved from the pretest to the posttest for matched items. This is not surprising as one would expect students to improve generally from pretest to posttest.

The next series of pre to posttest analysis were designed to determine if there was a game-effect on scores. This was done by comparing the game-related scores to the non-game-related scores for both pre and posttest scores. Again, only items that appeared on both the pre and posttest were used ("matched items"). Descriptive statistics are provided in Table 20.

Table 20

Descriptive Statistics for Pre and Posttest Matched Items

	N	Min	Max	M	SD
Matched Pretest (12 items)	22	.00	11.00	5.30	2.82
Matched Pretest Game (6 items)	22	.00	6.00	3.00	1.57
Matched Pretest Non-Game (6 items)	22	.00	5.50	2.30	1.49
Matched Posttest (12 items)	22	10.75	12.00	11.86	0.34
Matched Posttest Game (6 items)	22	5.50	6.00	5.91	0.24
Matched Posttest Non-Game (6 items)	22	5.00	6.00	5.95	0.21

After confirming all assumptions were met, two paired samples t-tests were run to compare: 1) pretest game-related scores to pretest non-game-related and 2) posttest game-related scores to posttest non-game-related scores. Results are shown below in Table 21.

Table 21

Paired Samples Test for Matched Pre and Posttest Game and Non-Game

		Paired Differences					t	df	Sig (2-tailed)
					95% Confidence Interval of the Difference				
		M	SD	SE of M	Lower	Upper			
Pair 1	Matched Pretest Game Matched Posttest Game	-2.91	1.61	.34	-3.62	-2.20	-8.46	21	.000
Pair 2	Matched Pretest Non-Game Matched Posttest Non-Game	-3.66	1.48	.31	-4.31	-3.01	-11.64	21	.000

Results in the above table (21) show there was a significant difference between the matched pretest game-related scores (M=3.00, SD=1.57) and the matched posttest game-related scores (M=5.91, SD=.24); t(21)=-8.46, p=.000 and that there was a significant difference between the matched pretest non-game-related scores (M=2.30, SD=1.49) and the matched posttest non-game-related scores (M=5.95, SD=.21); t(21)=-11.64, p=.000. Again unsurprisingly, these results show that student scores improved from the pretest to the posttest for matched items. These results also show there was a significant improvement for both game and non-game related items.

Comparison of game and non-game pre and posttest differences. In order to determine if the students' improvement in one of the pairs, game or non-game, was significantly better than the other, I attempted to run a final paired samples t-test that compared the

differences between matched pre and post-game scores and matched pre and post non-game scores. Descriptive statistics are provided in Table 22. Unfortunately, this comparison did not meet the required assumptions as the items were found to be significantly correlated (See Table 23).

Table 22

Descriptive Statistics for Game and Non-Game Differences Between Pretest & Posttest

	N	M	SD
Matched Non-Game Difference	22	3.66	1.48
Matched Game Difference	22	2.91	1.61

Table 23

Paired Samples Correlations for Game and Non-Game-Related Differences

		N	Correlation	Sig.
Pair 1	Matched Game-Related Matched Non-Game Related	22	.66	.000

Summary of analysis to support finding 2. While the series of paired samples t-tests I conducted showed that student scores did improve significantly from pretest to posttest, the results do not show a game-effect. This outcome must, however, be viewed within the context of the study which had a small sample size and instruments that were limited due to posttest ceiling effect and differences between the pre and posttest.

Findings for Research Question 2 – Part B

The third and fourth findings are derived from four qualitative data sets (student interviews, class debrief sessions, stealth pre and post-game assessments, and classroom

observations) and address research question 2, part B: In a second-grade history unit, what effect does curriculum-embedded gameplay have on students' learning & retention of concepts beyond those specified in the curriculum?

Finding 3. Qualitative data is mixed however suggest that there may be a game effect leading to greater learning "beyond the curriculum" and greater retention for some students in this study.

Analysis strategy. Analysis of the qualitative data derived from student interviews, class debrief sessions, stealth pre and post-game assessments, and classroom observations consisted of grouping data using a priori codes as described in chapter 4 and detailed in Appendix J. In chapter 4, I also noted that since research question 2 focuses on learning that occurs both as part of the intended curriculum as well as beyond the intended curriculum, I created three "levels" of content: 1) "Mastery" content - content that either is on the posttest or could be on the posttest. 2) "Exposure" - content that is part of the intended curriculum but that students are not necessarily expected to remember and would never be on the test. 3) "Beyond" content - learning that exceeds the intended curriculum but that is connected to the unit. As RQ2 also specifically focuses how an embedded game may influence learning, I also categorized each data example in accordance to its proximity to gameplay: "before" - data collected during the unit but before gameplay, "close" - data collected immediately following gameplay, "medium" - data collected during the unit but more than a day after gameplay, and "far" - data collected after the unit had concluded (Table 5 and Table 24).

Overall, slightly more than half (234/453) recorded examples of post-game learning (mastery, exposure, beyond) were game-related suggesting that gameplay did influence learning. This quantitative summary of the qualitative data, however, cannot be considered

comprehensive. Students may not be called upon in class, students may not be selected for interviews, and I may not have captured every pertinent event that occurred during observations.

Table 24

Demonstrations of student learning in relation to gameplay proximity

	Mastery	Exposure	Beyond
Before Game (Class Obs + PreGame Stealth)	74	77	2
Close (Class Debriefs + PostGame Stealth)	89	41	25
Medium (Class Instruction/Didactic)	81	128	0
Far (Interviews)	41	42	6

"Before game" demonstrations of learning were typically of "mastery" or "exposure" content that are closely aligned with the intended curriculum across tested and untested settings. "Close" demonstrations of learning, which occurred immediately after gameplay, expanded into "beyond" the intended curriculum and were balanced across tested and untested settings, getting well past what teachers expected. Demonstrations of learning that were of "medium" proximity to game play returned to representing a tight alignment with the intended curriculum and saw the disappearance of beyond-the-curriculum learning examples, representing the typical (real) pattern of classroom instruction. Finally, demonstrations of learning that were the furthest from gameplay, occurring after the unit had concluded, speak to what learning was retained by these students and returns back to a more balanced representation of mastery and exposure learning but with a small, but not insignificant, display of beyond-the-curriculum learning.

A theme that students may experience greater retention of game-related material emerged during the analysis of student interview (Appendix F) data that was collected several months after the game had been played and the unit had ended (Table 25). Data shows that students more

often recalled game-related content than non-game related content in all three levels of mastery suggesting that there may be a game-effect on retention.

Table 25

Number of Students Demonstrating Various Levels of Learning During Individual Interviews

	Mastery	Exposure	Beyond
Non-Game-Related	1	4	0
Game-Related	13	8	5
Total	14	12	5

N=18, total students interviewed

Teacher interview data also supported this finding of a game-effect on retention as evidenced by the following exchange with two teachers:

> And they remember what a missionary is, where kids in the past, they would get pilgrims and Moravians mixed up and these kids don't. [T3] And we even had... One time I even had a guest from a Moravian church come in who has been to Nepal and so on, so trying to tie it in with... [55] ...with present day missionaries, and it didn't hit them the same way the game has. (TI6 - T1 & T3 - 52)[4]

The third teacher continued by suggesting that the game may have positively impacted posttest scores for some students:

> I really do think the game contributed to [better test scores] because even some of my, I know I probably shouldn't say this, but weaker test takers did really well on this test. Kids that I may not have expected to do as well, I think did better, and I think part of it was their excitement about the unit. (TI2 - T2 - 35)

[4] Citation of qualitative data goes as follows: (setting, speaker if known, line in transcript).

By triangulating the various sources of qualitative data, I find indicators of a game-effect on learning beyond the curriculum and on retention, but the trend is not strong enough to be fully conclusive.

Findings for Research Question 2 – Part B (continued)

Finding 4. For participants in this study, students' learning from non-didactic instruction, specifically curriculum-embedded games, may extend beyond just learning and content acquisition and may increase
students' level of enthusiasm and sense of ownership of historical content.

Analysis strategy. After an exhaustive analysis of the data derived from student interviews, class debrief sessions, stealth pre and post-game assessments, and classroom observations, evidence emerged suggesting that student learning derived from non-didactic experiences may be qualitatively different than that generated by traditional, didactic forms of instruction. Specifically, student statements demonstrating knowledge gleaned from gameplay, field trips, and other out-of-your-seat activities were often relayed with sense of ownership and conviction. This was evidenced by speaking with an attitude of I know this, I am bringing my knowledge to the conversation, I am contributing, rather than repeating back what I just heard.

In one example recorded from a classroom debrief session that occurred immediately after gameplay, a student corrected another student's statement regarding the initial settlement of Bethlehem, displaying a high level of confidence: "No, it was the first house and THEN it was the Hotel Bethlehem," (CDT1 - S - 11). This theme that students felt a sense of ownership over knowledge learned from the game was corroborated in interviews with the teachers. As one teacher explained, "I think, that's a little bit empowering for them because they're like hey, we

already know about this. Whereas before, they didn't know anything until we told them," (TI1 - T2 - 33).

The theme of students bringing their own knowledge to the conversation was also supported in teacher interviews. As one teacher explained, "I don't talk a lot about George Washington, but they have since the game brought up things...that I do not say in the classroom. That would be an example that they've just out of the blue talked about," (TI5 - T3 - 65). These "out of the blue", yet relevant, contributions by students to the classroom conversation suggest that there was a game-effect on the students' sense of knowledge-ownership and a shifting of their role towards a "maker of meaning" from a just a receiver of knowledge.

Expressions of learning derived from non-didactic experiences were often rich in detail compared to expressions generated by didactic experiences as shown by this statement made by a student team explaining how colonial Moravian life was different than modern life during the post-game stealth assessment and shortly after a student field trip to the local Moravian Museum: "They got water. They got electricity from the Monocacy Creek. They made roofs out of clay. The first house was green, and it used to be at a place where Hotel Bethlehem is," (PGDB3 - T7 - 62). This team had been asked to name three ways life was different between then and now and instead gave five detailed examples, three referencing the museum trip and two referencing a quest in the game. During the pre-game stealth assessment, this same team had only named three ways, suggesting that perhaps there was a game-effect on learning.

Conversely, during regular didactic instruction, students regularly demonstrated knowledge of "mastery" material during class instruction but the statements typically followed a pattern where the teacher or chosen student would read a paragraph from workbook aloud and then the teacher would elaborate and explain the paragraph while prompting students

with questions derived from the reading. Students would answer these questions with language similar to what they had just heard. Often responses were only one or two words. For example, the teacher would read a paragraph describing the Bell House and how that was the building where the married couples resided. She would then ask the students, "Now, where did the married couples live?" and a student would reply, "The Bell House." Activities in workbook, such as coloring or word searches, were also very scripted with little room for personalized variation.

During this regular instruction time, students were also able to repeat back "exposure" content often in the same manner as the "mastery" content, without much detail. For example, after reading a chapter (17) about the Moravian cemetery that explained why all of the gravestones were the same, "...because the Moravians believe that in death, as in life, all people are equal," the teacher asked the class 'why were all the graves the same?' and a student replied, "Everyone was equal," (OB10H - S - 49) thus repeating back in part, almost verbatim, what he had just heard.

When students, however, referenced their non-didactic experiences, responses demonstrating exposure content learning were more detailed and richer. For example, during a lesson about the role of music in Moravian society, one student eagerly shared her memory of the music room in the Moravian museum, "When we went to the Gemeinhaus House, we went to the music room…and it had that Dr. Seuss horn!" (OB6H - S - 5). This student was able to name an important building without prompting and used her own descriptive language, "Dr. Seuss horn", to describe an instrument that she viewed as whimsical and unlike the traditional instruments she was accustomed to seeing. This theme was also supported during teacher interviews with one teacher explaining the game's influence by saying, "Oh yes, deeper

information than in the past they brought up again and again. So, yeah, definitely, [the game] helped them to give input and remember back to things in the game and then they were able to make more connections," (TI2 - T1 - 43).

During classroom lessons that involved content that had also been included in the game, students often recalled the co-occurrence excitedly. For example, when the lesson focused on the lamb on the Moravian seal, one student exclaimed, with great excitement, "That was in the game!" A lesson focused on Tschoop, a historical figure that was the focus of a popular game quest, elicited a refrain: "That was in the game!" These recollections appeared to often raise the level of engagement and excitement during classroom instruction. For example, one student was trying very hard to remember the name of a less-prominent building in the game, the Nain House, and once he finally remembered the name, he was so excited he actually fell out of his chair. Another student eagerly recalled his efforts to find Tschoop's ghost in the game while another student, when shown a painting in class of Tschoop excitedly exclaimed, "that picture was in Mrs. Oltman's game!". This theme was supported by data gleaned from teacher interviews. As one teacher explained, "I think it makes them more excited about the unit. My class had done [the game] early on in the unit, and it definitely gave them some ... a little bit of background knowledge to say, 'Oh yeah. I remember when,' and it gave them a little more enthusiasm about learning about the unit because history can be kind of dry sometimes," (TI3 - T1 - 136). This ability to recall details from the game suggests that the action of playing the game left an indelible impression for some students and garnered genuine excitement and enthusiasm.

An analysis of the data, however, was unable to identify any examples where students expressed learning that went "beyond" the curriculum during regular didactic instruction.

Observer notes suggest that this may simply be a result of the typical lesson structure where the teacher felt some pressure to “get through the material” and allowed little variance from the subject at hand by leading and managing the direction of the class discussion.

Although no evidence suggests that gameplay enhanced beyond-the-curriculum learning during regular classroom instruction, there was evidence supporting a game-effect on students’ sense of knowledge ownership and enthusiasm for the intended curriculum. In the quote below, this teacher describes the students’ shift from learner to teacher.

> ...about how much they enjoyed the unit and about how much they taught, the children taught their parents about the history because how much they remembered, even down to the dates and the details, and I think that you, the fact that you used so many specific examples from the book, like the seal, when we got to that page in the book they were like, "oh we remember that and the lamb!" and so they were referencing the game. (TI2 - T2 - 53)

This shift of student to teacher perhaps the most convincing evidence of when knowledge has been internalized by the learner. During a post-study member check with participating teachers, this finding was affirmed by all the teachers with one teacher stating that this phenomenon is even “still continuing today” (MC – T3 – 1) with students who have recently played this game.

Findings for Research Question 3

Three findings emerged from the data to address the third research question: In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

This section will address each finding by providing supporting evidence and an explanation of analysis. However, as stated in Ch. 4, there is a caveat to these findings. Each of

the three findings related to the teachers' instructional planning and decision-making must be considered within the context of this study's design-based research approach. I acknowledge that the evolution of the teachers' instructional practices did not occur independently but rather emerged from a combination of game-based learning experiences and the my presence. While it may be understood that it would be nearly impossible to fully disentangle my presence from the effects of this game-based learning experience, it is necessary to qualify the following three findings. For example, one teacher explained the influence of the my presence and her participation in the study as thus:

> I think I thought about you coming in... It really made me analyze the way lessons were presented. It did. The one activity you said, 'Did you do this last year?' I did not. I would have offered more teacher guidance to the kids whereas I'm thinking ... I think this again is how you set the tone in a child's discovery of something. Instead of me just guiding them in the lesson on the smart board, it was more hands on with the game. I think you influenced the way I presented the material. (TI7 - T3 - 23)

This influence, however, was not viewed as critical assessment or in a negative way, as the same teacher further explained while comparing my presence to that of a formal supervisor's observation, the teacher explained, "I didn't see you that way. I just saw you as a person who was interested in the way children learn, and that made me look at the way things are taught a little bit more carefully," (TI7 - T3 - 37). The other teacher in year 2 concurred with this assessment by saying, "You (the researcher) just became part of the lesson," (TI7 - T1 - 43). Although I became a "part of" the teaching and learning experience, the teachers' participation in this study at minimum influenced and at most acted as a catalyst for the evolution of these teachers' perceptions of game-based learning and modifications to their instructional decisions.

Findings for Research Question 3 (continued)

Finding 5. Over the course of two years, these teachers' perception of the instructional role of the curriculum-embedded game evolved from being an 'add-on' to being a catalyst.

When I first approached the second-grade teachers seeking permission to partner with them for this study, the teachers all expressed enthusiasm for the project and were eager to participate, "help" me, better utilize technology into their instruction, and as one teacher stated, "I was excited about you know, beefing up our program, bringing it more into the 21st century sort of thing," (TI2 - T1 - 70). This initial enthusiasm persisted throughout the study, however, the perceived instructional role of the game evolved. As on teacher explained post-unit after year one:

> I feel like the game connected them to the history on a level that means something more to them instead of just reading it from the book. Because...I knew they'd be excited about the game because it's a game, but I really feel like there was a solid connection there and I knew that they would love the game in the moment. I didn't expect it to carry through as much as it did. I mean I was pleasantly surprised that it did, like I knew they'd be excited that day, but then I thought it would be like, ok, we did it and now it's done, but that wasn't, at least for my group, that wasn't the case. (TI2 - T2 - 82)

Being "pleasantly surprised" that the game's influence extended well beyond the actual gameplay, suggesting even that history may "mean something more" to students because of the game, speaks to the evolution of the teachers' perception of the game's effect.

As this evolution progressed over the two years, teachers were observed pulling the gaming experience into instruction by referencing game events. As one teacher explained, "We

were able to say, 'Do you remember this? Do you remember seeing the seal when we were out?' And so, we could bring the game back in," (TI2 - T3 -37). Over the course of 17 observations in year two that occurred post-gameplay, teachers were observed referencing the game during regular class instruction 14 times.

Towards the end of the 2nd year unit, one teacher also explained how a better understanding of the game enhanced her ability to integrate it even more into instruction compared to the first year:

> Well, I felt like I knew the game better this year. I felt more successful [than] when we first played it...I think I went into the study with a better understanding of what you were expecting from the game for the kids to learn. Thus, I could bring it into the classroom, then, and make sure some points were made in the teaching or guide the kids toward making some observation through the game. So, I think my teaching was different this year just because of my understanding of the game. (TI6 - T1 - 91)

This deliberate integration of game content into regular instruction supports the finding that over time, teachers' perception of the curriculum-embedded game evolved into something substantially more than just a supplemental activity. As one teacher justified the value of gameplay she said, "I could easily see adding another day of it," (TI7 - T3 - 133), and expanding on this sentiment by saying, "...if we could find a way to make [the game] part of the curriculum. You know right now, it was something extra that we were trying ... we found the time, but if we could fit it in and just make it a part, then I think we would really be comfortable with having it as part of that topic," (TI2 - T3 - 119). This willingness to devote more time to gameplay is particularly noteworthy as instructional time is a precious commodity in schools. One teacher described how other fun unit activities such as building Lincoln Log structures or weaving with

looms have been removed in the past due to time constraints, “Some things they just get cut because of time...The things that kids found so much fun...that's what's getting really squashed, taken away,” (TI7 - T3 - 226). Teachers reserve time for activities they feel are worthy and evidence suggests that over the course of this study, gameplay earned this designation.

This finding was also affirmed by the teachers during a member check with one teacher explaining, “we always have games that help with spelling and math that are good, but history is harder…but your game really helped us make the history easier to teach and learn” (MC – T1)

Findings for Research Question 3 (continued)

Finding 6. Enacting a curriculum that included an embedded game encouraged these teachers to shift from direct instructor to learning facilitator.

Data shows that over the course of two years, the participating teachers’ recognition and value of student-centered learning was enhanced by their experience with a curriculum-embedded game and that their belief that active learning was more effective than passive learning was affirmed. As one teacher explained, “Getting outside and walking around and going to those buildings for a purpose...helped. Yes, and not just walking there and reading the historic label or just reading about it in a book. [The game] brought it more to life,” (TI7 - T3 - 251). Data showed this shift was enacted and evident during the post-game class debrief sessions where the teachers were more likely to allow students to bring their own meaning to the discussion instead of the teacher “just telling” the students information as often occurred in regular classroom instruction. For example, when describing his in-game experience of trying to figure out the correct order the places of worship were built, one student said, “I knew the Central Church was the last one because it looked like it wasn't built long ago at all,” (CDB2 – S - 125). This student used his own observation skills and reasoning to deduce that the Central

Church was the newest of the three buildings. This is a fundamentally different learning experience than reading about the construction history in the textbook or having the teacher tell the students the correct order.

By the start of the second year, teachers were even asking me if the game could perhaps assume the role as the core instructional instrument rather than the teacher: “What do you think about using this as the beginning of a lesson and then our part is more of the enrichment type? We'll just kind of flip-flop things. What do you think?” (TI3 - T3 - 149). By expressing this willingness to relinquish the responsibility of providing all content knowledge, the teachers exhibited a strong openness to transforming their role in the learning process.

Data analysis, however, revealed that this willingness to assume the role of “guide on the side” as opposed to “sage on the stage” may not simply be a result of experiencing a curriculum-embedded game as this sentiment also aligned well with the school’s educational heritage and immediate professional development goals. As one teacher explained, “The Moravians [who founded the school], Comenius, his thought was to learn through play. I think that's always in the back of our minds,” (TI3 - T1 - 72). However, although this philosophy seems to be well grounded in Moravian educational culture, the curriculum-embedded game experience may have provided a catalyst to its further adoption in actual instructional practices. As one teacher shared:

> Over the summer we read the Creating Innovators book and then some of us read some additional books along the same line about how to work with students today and have them think outside the box. Look at a different way that we can present material. Your activity with the kids was just foremost in my brain as I'm reading this because that is exactly the sort of thing that I think the book was trying to have teachers think about

doing. As opposed to just the way it has always been done, for the last 100 years. (TI3 - T3 - 41)

This study may have provided the teachers with a tangible example of seeing Comenius' original vision enacted in a modern setting and motivation to continue their pedagogical evolution.

During the member check with teachers after the study had concluded, all of the teachers affirmed this finding with one noting that the data I shared with them "speaks to me, that makes them responsible for the learning...versus the teacher walking around reading to you...they were in charge of their learning, this experience gave them ownership" (MC – T2).

Findings for Research Question 3 (continued)

Finding 7. Experiencing a curriculum-embedded game influenced these teachers' attitudes regarding game-based learning and impacted instructional decision-making.

None of the three teachers who participated in this study would characterize themselves as "gamers" and thus their experience with recreational games was limited and possibly influenced their initial perceptions of games in general. As one teacher explained at the conclusion of the first year, her perceptions of game-based learning (GBL) improved due to her experience with study, "It's changed my overall opinion towards gaming some because I feel that children have lost a lot of fine motor skills...because of all of the gaming and electronic things they've been doing over the years. But I have seen, there's validity to using it also, so it's brought my opinion up. [laughter]," (TI2 - T1 - 109). After the completion of the second full year, this same teacher was more emphatic about the benefits of GBL. When asked if how this study influenced her perceptions of games for learning, she responded without hesitation, "Definitely for the positive," (TI7 - T1 - 242). The data suggest that part of this positive attitude towards GBL was driven by a recognition of some of the previously unrealized strengths of GBL such as

"reaching" different kinds of learners and personality types. As one teacher said during the final interview,

> I think it [the game] brings in kids who...we have all these modalities, and children learn a different way. It just kind of pulls it all in. No matter what kind of learner you are, visual or auditory or kinetic, it's just all there when you're doing the game. It also brought out kids who were a little bit more subdued in the classroom, and I love seeing that. One of the quietest children in the classroom was having the best time ripping around and running with her iPad. (TI7 - T3 - 244)

Throughout the study, I did not observe any reluctance or hesitation to include the researcher-designed game-based learning experience in the instructional unit but rather noted the teachers' exploration and use of other games and game-mechanics during instruction. For example, one teacher described her increased use of teams based upon the collaborative benefits she observed from team play in the researcher-designed game, "There was also more of a focus, I think, on teamwork in both of our classes. Because you did that with the game...And I did that with many of the puzzles. Got into teams, instead of individuals as we had in the past," (TI6 - T3 - 97). In addition to bringing more GBL into the classroom, data also shows that teachers tried to bring more curriculum into the Moravian game. For example, the study unit completed prior to this Moravian unit was a "Maps" study. One teacher tried to bridge the learning from the maps unit into the Moravian game as she explained, "We talked about actually using the map skills and that the blue dot represented them so they were paying more attention to where the dot was moving instead of taking the information from the quests and say 'oh, I know that's the chapel' and taking off to it," (TI1 - T1 - 49). This observed fluidity between curricular content and GBL modalities suggests that the teachers had embraced the efficacy and validity of GBL.

Teachers were also observed allowing the students' game-based learning experience to infiltrate and influence classroom discussions during regular instruction. One teacher described an example of the game's effect on classroom discussion by saying, "We've pulled in talking about the Revolutionary War much more than usual," (TI5 - T1 - 66), while another teacher further described her efforts to use game references to improve students' connection and engagement with the material by saying, "Instead of boringly reading the information and then going over it, but trying to pick out things [that related to the game] as we went along with the reading that kept them excited and wanted to go on," (TI6 - T3 - 32). The teachers recognize the importance of having excited and motivated students and embraced the gaming experience as a tool to elicit such a connection to the classroom learning experience.

Additionally, in year two, I observed both teachers use Jeopardy-style games to enhance review sessions, however, when asked about these games the teachers acknowledged the difference between different types of game experiences. As one teacher explained, "Even our clicker activity, it is really nothing more than a pencil paper... put up on a smart board. Using more modern technology but really, it's the same outcome. The same way it is achieved except you're pushing a button instead of pushing a pencil," (TI3 - T3 - 77). This teacher understood how the researcher-designed game was fundamentally different than the teacher-designed review game and relayed a bit of dissatisfaction at that difference.

Upon understanding that learning games could go well beyond simple "pencil and paper activities transferred to a Smart Board," the teachers began to envision how games could be better used in other subjects. As one teacher theorized, "Any type of literature, you could bring [GBL] into...all the stories that we read, I'm sure we could do something with black history month... something could tie in with that," (TI7 - T3 - 259). Envisioning a new game that goes

beyond a quiz-type game suggests that the teachers began to develop a broader sense of game design and a more constructivist view of GBL.

Early in the study, teachers actively considered how to best implement the game into the curriculum to increase its effectiveness. During year one, this teacher explained her perception of how placement of the game within the curriculum impacted the learning experience:

> I liked the timing of it ... I liked how it fell in with our visit to the Moravian Museum and it just seemed to get them excited about all of it because it was all happening at the same time and it seemed to bring it to life for them. Like I had a bunch of kids comment about having conversations with the people in the game, and that made it a lot more exciting than just reading about it. (TI1 - T2 - 16)

As the study progressed, the teachers began to make more proactive adjustments to their instructional practices to preserve the gameplay experience thus acknowledging the importance of an authentic gameplay experience. As one teacher explained, “I have to say, I think about it. I intentionally do not bring it into the lesson because I'm thinking they need to discover things as they're playing the game…. I want the game to have these fresh parts,” (TI4 - T3 - 60). This teacher made an intentional instructional decision to preserve the gameplay experience by omitting curricular content in order to allow the students to organically discover and make meaning during play.

During the second year, the teachers began to express a desire to shift away from lower levels of learning to deeper understandings. As one teacher explained, “I feel like I haven't been pounding in the history so much...I mean dates and specific things... and [instead] getting them to think more about how that time relates to our time now or how they would feel during that time period,” (TI4 - T1 - 70). This effort to emphasize deeper understandings also emerged in the data

when the teachers asked my opinion about using the game as an assessment tool instead of the current unit posttest. “We've been talking about the written test and how there are other ways for the kids to show they're learning, and it would be interesting to view that [game] as their assessment,” (TI2 - T1 - 84). The teachers clearly felt the current unit test did not assess what they now felt was the intended learning outcomes they wished the students to experience. While this evolution may or may not be a direct result of their experience with a curriculum-embedded game, it did arise during a discussion about game-based learning and the proposed solution was using a game as assessment, a relationship between the teacher’s perceptions of assessment and levels of learning with games for learning does exists and perhaps warrants further study.

Finally, a culminating example of how experiencing a curriculum-embedded game may influence teachers’ instructional practices or decision making emerged from the data as the teachers seemingly evolved from simple teacher-consumers of a game that I provided to becoming full co-designers of future iterations of the game. By the end of year two, the teachers were actively brainstorming with researcher on how to expand Moravian game, now thinking as designers. During the end of the final interview, a discussion ensued between the teachers and me about how to manage the logistics of adding a new level of content to the game that required travel to a location across a busy street:

T1: What would be neat is having one level down at the industrial area.

T3: You had thought about that, right?

R: Yeah, and that's actually ... Now that you bring it up, I re-thought it, yeah. Could we do it? Then the gamer in me is like, "What if a kid blows through a level, 'Let's get to the next one?'" You know what I mean? Do I have some kids down there and I have some kids down here? You don't want to hold them back necessarily playing.

T1: Oh, right.

R: Right? Could you do it such that the progression is manageable? Somebody's not going to get four levels ahead of somebody ... Maybe you have one person crosses on this side of the street, one person on this side of the street watching four kids, watching six kids.

T1: Yeah. I was forgetting about the level. Too bad it couldn't be a whole separate ...

R: A mini game.

T1: Maybe an intro mini game. Then bring them up here or have them up here and then go down there.

R: A series of games.

T1: Kind of, yeah.

R: Okay, we're going to ...

T3: A choir house game, an industrial area game. Is that what you're thinking? A God's Acre game.

R: In the Moravian game series.

T3: In the series.

At this point in the study, the teachers and researcher had become true partners in design with the ideas for further development flowing rapidly between all participants. This is a significant change from the teacher's original perception of the game being something I was providing simply as a supplemental activity.

During the member check with teachers, all three teachers affirmed this finding with one observing that "anytime you try anything like this it's going to change the way you teach for the better…because you take their excitement and let it guide you" (MC – T3).

The last chapter in this study includes a discussion of these findings relative to the previous literature as well as a discussion about implications for practice and directions for future research.

CHAPTER 6

Conclusions and Implications

As noted in chapter 2, very few studies have examined serious game-based learning within a social studies context nor have any studies been identified that explore this use with an early elementary school setting. This study extends the previous work done in game-based learning by doing just that; examining the effects of a curriculum-embedded game on early elementary students within a social studies unit while specifically exploring the impact on student experiences, learning, and teacher instructional practices. This study is particularly significant because it takes a much deeper look at the instructional importance of GBL by looking at not just the game but the curriculum surrounding the game, particularly as teachers adapt their teaching to take advantage of the game. This study employed a mixed-methods, design-based research approach and explored the following questions:

1. In a second-grade history unit, what are student experiences playing a curriculum-embedded game?
2. In a second-grade history unit, what effect does curriculum-embedded gameplay have on…
    . students' learning & retention of curriculum-specified content?
    a. students' learning & retention of concepts beyond those specified in the curriculum?
4. In a second-grade history unit, what effect does curriculum-embedded game-based learning have on instructional planning and implementation?

Over the course of two years, I conducted a design-based research project that embedded an augmented reality game within an existing history unit focusing on colonial Moravian society.

After analyzing quantitative data from pre and posttests, flow scores as well as a plethora of qualitative data such as interviews and observations, seven findings emerged which suggest that students generally had a positive experience, that their learning outcomes may have been influenced by the game, and that the teachers' instructional practices and decisions were influenced by the embedded GBL experience. The findings are reviewed below.

Review of the Findings

The first finding addressed research question one and examined student experiences while playing a curriculum-embedded augmented reality game for elementary social studies. The analysis of quantitative flow scores, triangulated with supporting qualitative data from student interviews (Appendix F) and post-game class debrief sessions, showed that these students experienced the game as a "real game", finding it enjoyable, immersive, and worthy of play. While there was some counter evidence suggesting that a very small number of students did not have a completely enjoyable experience due primarily to "partner issues", the large majority of students experienced both flow and the magic circle during gameplay.

The next three findings addressed research question two by examining student learning within and beyond the intended curriculum. To examine student learning, I implemented both quantitative analysis of pre and posttest scores as well as qualitative analysis student interviews, observations, class debrief sessions, stealth pre and post-game assessments, and teacher interviews. Finding 2, that there are inconclusive indicators of curriculum-specified learning, was formulated after running a series of paired samples t-tests on the pre and posttest scores. This analysis points to the relative limitations of the teacher-designed pre and posttests in that they both produced a ceiling effect and in that they were not identical.

The third finding addressed beyond-the-curriculum learning and while qualitative data is mixed, it does suggest that there may be a game effect leading to greater learning beyond the curriculum and greater retention for some students. Data showed that while students were able to demonstration "mastery" and "exposure" content throughout the unit and even later after the unit had concluded, demonstrations of learning that went "beyond" the intended curriculum were practically non-existent during regular instruction. A meaningful number of demonstrations of "beyond" learning, however, did surface immediately after gameplay and then a smaller, but not insignificant number occurred again much later during the student interviews which happened after the unit had concluded. Thus, a trend that beyond learning and retention was influenced by gameplay was identified but it is not strong enough to be fully conclusive.

It must also be noted that the qualitative data are not comprehensive, nor could reasonably be assumed to be so. I did not attend every lesson, not every student was called upon in class, and not every single statement of every student or teacher was recorded over the course of this study. In short, I did not capture all of the data that existed.

The fourth finding also addressed learning by examining qualitative data. Evidence emerged suggesting that, for these students, learning derived from non-didactic experiences, particularly game-based learning experiences, may be qualitatively different than that generated by traditional, didactic forms of instruction. Students spoke with conviction and a sense of ownership when demonstrating learning that was generated from non-didactic experiences such as gameplay and field trips. Students relayed knowledge with an attitude of 'I know this, I am bringing my knowledge to the conversation, I am contributing, rather than repeating back what I just heard'. While this finding emerged primarily from student interviews, class debriefs, and classroom observations, this finding was also supported by teacher interview statements.

The remaining three findings addressed research question 3 through an intense qualitative analysis of teacher interviews and classroom observations. The following findings spoke to the relationship between this game-based learning experience and these teachers' instructional practices and decision making. I acknowledge that these teacher-related findings did not occur in a vacuum but rather emerged through a combination of the teachers' experience with game-based learning and their interactions with me.

Finding five was that these teachers' view of the instructional role of game-based learning shifted over the course of this evolved from being an 'add-on' to being a catalyst. When the study first started, these teachers were excited to try something new and viewed the game as supplementary to the unit. By the time the study concluded, these teachers viewed the game as a core part of the unit and something that was instrumental in generating student excitement and enhancing student learning.

Finding six observed a shift of these teachers from direct instructor to learning facilitator. As the teachers began to recognize the power behind students bringing their own knowledge to the class discussion, instead of the teacher reading or telling them the information, the teachers began to embrace and encourage this more student-centered approach to instruction. Early in the second year, one teacher even indicated a desire to "flip" the role of the game and the teacher by suggesting that the teachers become the "enrichment" tool and the game be the primary source of student learning.

The final finding, number 7, suggests that this curriculum-embedded game (CEG) experience influenced teachers' attitudes toward game-based learning (GBL) and impacted instructional decision-making. Qualitative data supports this finding with evidence showing a progression of the teachers' view of GBL as a nice add-on and something fun to being something

so instrumental to instruction that they would make instructional decisions with an intent to preserve the game experience for their students. The final interview with the teachers also showed that not only had the teachers embraced the role of facilitating the implementation of GBL through instructional decision-making but also began to embrace the role of GBL designer by brainstorming with me on how to improve the game even further.

Through these seven findings, I propose that these elementary students did have a positive game-playing experience, that their beyond-the-curriculum learning and retention may have been positively influenced by this CEG, and that this experience certainly modified the teachers' relationship with GBL. These findings create several areas for discussion, each of which will be detailed below.

Are Games Good for Learning?

Previous research supports the assertion that GBL can be successful in generating positive learning outcomes (Hoffman & Nadelson, 2010; Gee, 2003; Prensky, 2001). While this study does not refute that assertion, it was unable to produce robust supporting statistical evidence due to lack of sensitive instruments (tests that rendered a ceiling effect) and by low numbers. This study, therefore, cannot be offered as an additional study of GBL efficacy on learning outcomes based on these quantitative results. Robust qualitative data, however, allowed for deep analysis which provided more promising, although not fully conclusive, results. This study is unique in that it explored serious GBL within a previously unstudied population: young elementary students. The promising qualitative results of this specific study align with previous GBL research that supports the efficacy of GBL (Hoffman & Nadelson, 2010; Gee 2003; Prensky, 2001) in suggesting that these students engaged deeply with the gaming experience and perhaps experienced more meaningful learning. Due to this alignment with previous GBL

research, I suggest that the inconclusive quantitative findings point more so to the inadequacy of the instruments and quantitate of the data collected rather than undermining the value of GBL as a useful instructional tool.

What this study does offer in terms of student learning are findings that suggest games may help awaken the students' schema so that they are better primed to generate their own meanings when presented with additional information. While there is scant literature that directly connects game-based learning to schema theory, Plass, Homer, and Kinzer (2015) do suggest that since play is "the essential activity in games" (p. 259), it is reasonable to apply Piaget's theory that play activates children's "schemas in ways that allow children to transcend their immediate reality" (p. 259) when studying games and learning. By being fully immersed within the Moravian game-world, these students began to formulate an idea of what this society was like and how it functioned. For example, after viewing, 'meeting', and 'talking' to in-game missionaries these students began to create their own meaning about what being a missionary means and internalizing the idea that Moravian society was overflowing with missionaries and other people focused on religious work. Thus, when additional information was introduced during regular instruction, the student had a "place" to put that knew information, further fine-tuning a schema that had already been generated by the game. This is evidenced by qualitative data such as the example of students that have played the game no longer mix up missionaries and pilgrims whereas students in previous classes regularly confused the two despite continued efforts by the teachers to provide clarifying information. A game allows educators to present content in context far better than any textbook or lecture could.

Digital games, such as the one in this study, can also be considered to be "multimedia objects" in that they incorporate various forms of media such as maps, images, and text. Mayer

and Chandler (2001) found that "incorporating a modest amount of interactivity [into multimedia presentations] can promote deeper learning," (p. 396). Digital games are by definition a form of multimedia presentation and they are certainly interactive. If games can provide a vehicle by which students can begin to generate their own deeper understandings about curricular content, then it is reasonable suggest that Vygotsky's pivot theory (Vygotsky, 1967) may be used as a framework to understand how student learning is influenced by games. The game acts as a pivot; something that the student adopts to create new meanings. Through the use of the game as pivot, the student's learning is accelerated and deepened, and because the learning is student-generated, there is a greater sense of ownership over the knowledge. Siler (2011) evoked Vygotsky's pivot theory explain the efficacy and value of models in middle science instruction. As noted in chapter 2, one particularly relevant example was that of a student who created a model of a cell using the metaphor of a hockey game.

> The ice is the cytoplasm, which holds the parts of the cell together…. The hockey sticks are the endoplasmic reticulum, or the transportation system. The Goal is the mitochondrion, which is the powerhouse. Basically, that's the name of the game. Because without the "goal" [of survival], what's the point of playing the game in the first place! (p. 422).

Siler (2011) explains that "symbolic models serve as pivots that enable adults to rekindle that fundamental connection with early childhood—in particular, the ability to play with ideas and their possibilities" (p. 420). While Siler's study uses Vygotsky's pivot theory in the context of science instruction and he doesn't explicitly talk about the power of games as pivots, the above example does demonstrate the specific metaphorical power of games as models or pivots and could easily be applied to social studies instruction.

Of course, students do not embark on their learning journeys alone. Teachers play a vital role through their instructional planning and decision-making. While there is existing literature that examines teachers' attitudes about and adoption of GBL (see Bourgonjon, De Grove, De Smet, Van Looy, Soetaert, & Valcke, 2013; Ketelhut, & Schifter, 2011), I could not find any previous literature that specifically studied the influence of GBL on elementary teachers' pedagogical instructional practices and decision making. This study is a rare instance of not only researching a curriculum-aligned game—purpose-built for the instructional context rather than being used off-the-shelf—but fully examining what happens throughout the entire unit of instruction once the game is embedded within the curriculum. Furthermore, this study followed the implementation of a curriculum-embedded game over two years, thereby allowing me to observe the effect on teachers' pedagogy over time. With findings indicating this experience did indeed influence the teachers' instructional practices and decision-making, it is clear that there is a ripple effect generated by GBL that extends far beyond just student learning. GBL also impacts our teachers and thus the entire learning ecosystem.

As discussed in chapter 2, a constructivist approach has been recommended by the National Council of the Social Studies (Myers et al., 2006) for social studies instruction. In order to align with this recommendation, a teacher's role must shift from "sage on stage" to someone who facilitates, scaffolds, and guides students meaning-making. My study suggests that game-based learning may aid in this shift and provides additional support for the notion that GBL is well-suited to support constructivist learning as games are inherently learner centered, focused on player agency, and provide a flexible platform on which to design activities that require higher order thinking and meaning making within relevant contexts (Steinkuehler & King, 2009; Boyle, Connolly, & Hainey, 2011).

Previous literature tells us that active learning activities and social learning can improve retention rates (Rahn & Moraga, 2007; Prince, 2004; Vygotsky, 1978) because as Nuthall (2000) argued, students learn what they experience. Active learning is also often connected to deeper learning and more critical thinking (Rahn & Moraga, 2007). The findings of my study support these assertions and provide additional evidence that GBL, as an active and social learning experience, is a valid approach to creating meaningful learning experiences.

Implications for the Design & Implementation of GBL

Of course, all of this magical learning within games only occurs if the gaming experience is robust and enjoyable. If a student detests playing a game, it is reasonable to suggest that learning will be limited (Charsky, 2010; Garrigan, 2017; Gee, 2003; Prensky, 2001; Prensky, 2006;). "Good" games provide an opportunity for learning. The findings of this study affirm that the constructs of flow (Csikszentmihalyi, 1990) and magic circle (Klabbers, 2007) can be used to gauge gameplay experiences and I suggest that game design decisions should be driven by the intent to generate these two experiences for players. This section will detail three factors that influence player experiences and increase a player's likelihood of experiencing flow and a magic circle. Factors that emerged from the data are: 1) perceived level of enjoyment, 2) quality of partner experiences, and 3) perceived quality of the game itself.

Importance of Enjoyment. Qualitative data showed that the students in this study enjoyed playing this curriculum embedded game as part of their learning experience. Every student interviewed expressed a sentiment similar to "I liked it. It was really fun," (SI46 - S46 - 18) and during post-play class debriefs students also expressed a high level of enjoyment such as this, "I loved it the way it is and nothing should change about it because it was perfect. It was like best game that I ever played outside in my life," (CDT2 - S54 - 42). During teacher

interviews, the teachers also relayed many times how much their students enjoyed the gameplay experience, “Well, I can assure you every child in my classroom thoroughly enjoyed this. There was not one child who did not have fun doing this game,” (TI1 - T3 - 219). Enjoyment is important both because it is an indicator of flow (Csikszentmihalyi, 1990) and because only when a game experience is perceived as “fun” will the player readily enter the magic circle (Klabbers, 2007). As the qualitative data shows, a high level of enjoyment was experienced by these students and so I can say with reasonable confidence that these students well positioned to experience both flow and the magic circle. This finding, combined with the teachers’ emphasis on the students’ high level of enjoyment suggests that creating enjoyable games is important and should be one of the designer’s primary goals.

Importance of partner experience

Existing literature is ripe with work that supports the efficacy of social and collaborative learning such as Vygotsky’s More Knowledgeable Other (MKO) and Zone of Proximal Development (ZPD) (Vygotsky, 1978) (See also Gokhale, 1995; Kuo, Hwang, & Lee, 2012; Schellens, & Valcke, 2005). There has also been some research that has specifically studied collaboration in game-based learning. For example, Sung & Hwang (2013) created a collaborative game for sixth-graders in a natural science course where students used a “Mindtool” to document their findings and gameplay. The study found that this approach improved the students' learning achievement, self-efficacy and attitudes about learning. Sánchez & Olivares (2011) found that a mobile serious game could enhance collaborative and problem-solving skills among 8th grade science students. While each of these studies focuses on collaboration within GBL, neither one specifically addresses the importance of the partner-selection nor examines populations as young as second grade. There is a plethora of educational

research that looks at student groupings (See Dunn, Giannitti, Murray, Rossi, Geisert, and Quinn, 1990, Slavin, 1987, Ward, 1987). Data from my study, however, suggests that the "partner experience" specifically in game-based learning environments, such as how two children get along with each other, share with each other, and talk to each other, may be an important area to study.

Fourteen of the eighteen students interviewed indicated that if they were to play this game again, they would like to play again with a partner. This was due mostly to the perception that playing with a friend would be more fun and could be helpful. "I mean it's like more fun to do it together. We can explain what's happening to each other, and we can solve out problems together," (SI15 - S15 - 55). Students understood that their partners had the potential to both make the experience more fun and more successful.

Four of the eighteen students interviewed, however, expressed a desire to play the game alone if they were to play again. This desire to play alone was driven by difficulties experienced with their earlier gameplay partner mostly concerning sharing the iPad or was driven by the idea that they could simply play faster alone, and they wanted to make as much progress as possible. "Because I can get stuff done faster because I don't have to keep telling them it's this way and we don't have to keep complaining about which way we should go first," (SI47 - S47 - 66). This desire to "get stuff done faster" is further indication that the students enjoyed the game, had accepted the magic circle, and thus wanted to be able to play well but that the frustration derived from a lack of partner cooperation was certainly a barrier to flow. These students essentially wanted to expel their partner from the magic circle and have it to themselves. One of these four students, however, was open to the idea of playing either alone or with a partner but it had to be a partner that was a "good" partner, "I would play with a teammate or by myself...For instance, if I

was playing with my brothers, I would have to fight who gets the iPad," (SI44 - S44 - 70,74). These students explained that "bad" partners are not fun and hinder game success thus affirming the proposition that the partner experience is important.

Each of the three teachers also spoke to the importance of well-selected pairings to enable a positive playing and thus learning experience. As one teacher explained, "I asked my kids...did you like working in partners or would you prefer to do it by yourself? And they all liked the idea of partners. And I personally think it was really good having partners as opposed to individuals because I have some very weak readers." (TI1 - T3 - 107). This idea that a students' partner experience is important can drive certain implementation decisions such as how pairings are determined and how roles are defined between players. If we know that sharing the iPad may be an issue, it may be a good idea to proactively provide guidelines to the students about how and when to share the iPad.

Importance of the game experience – i.e. design is important. As noted in chapter 2, McLuhan's (1964) premise that "the medium is the message" can be easily applied to a consideration of the gaming experience. Just as we cannot assess the value of television by simply measuring content preferences, viewing time, and vocabulary counts, we cannot measure the value of digital games by only considering the types of game mechanics and design elements employed. We must look at the sum of the parts and consider what kind of game experience is created when these elements are strategically applied. Arnold, Koehler, and Greenhalgh (2016) argued that that designing for immersive experiences is a key element in maximizing the learning potential of games. Well-designed games are powerful because they generate immersive game experiences, not because they have certain mechanics or game elements. This is demonstrated by the incredibly diverse range of "good games". There is no one magic formula for creating a great

game, however, game design must keep an eye toward creating a robust magic circle (Klabbers, 2007; McGonigal, 2011; Walz & Deterding, 2015) and, I would argue, the potential for a flow experience (Custodero, 2005; Sherry, 2004) .

Throughout the qualitative data there was evidence that the perception of this particular game was that it generated a very positive game experience and that this perception was driven by the game "feeling real", containing good game elements, and the game feeling like a "real game" all of which are elements of quality game design. One student described her playing experience as, "Sometimes, I felt like it was so real that I almost wanted to touch it," (CDB1 - S20 - 13), while another expressed sincere empathy for a game character, "Like when we saw the picture, it was a painting of the First House, I felt so bad for her I just wanted to build it again," (CDB1 - S22 - 60). These emotional connections to the game leave an indelible impression on the learner and may help to activate schema and drive retention. Within the data there was some evidence that implementing good game mechanics and good media aided with generating the perception of a game being "good". As one student explained, "It was fun searching for the places we need to go and getting refreshed at the praying station...the pictures were looked awesome when they, they looked like almost real pictures," (SI15 - S15 - 2,10). Because the game was viewed as a quality game and the game experience was good, it was more readily adopted by the student as an activity worthy of pursuit.

Limitations of this Study

There are several limitations to this study that must be acknowledged when considering the above findings and when pondering future research (which I address in the next section). For the reader's reference, chapter 4 provides an extensive examination of this study's limitations

and strategies I employed to minimize these limitations, however, I have listed several key limitations below that are particularly relevant this chapter's discussion:

- Students participating in this study were generally from higher-income families.
- This study took place in a small, expensive, urban, private school.
- This study did not have a control group.
- The population studied was small in number.
- The unit assessment produced a significant ceiling effect.
- While the teachers in this study varied in age and experience, all were all Caucasian females.

It is unknown if similar findings would be replicated in a different setting, different instrumentation, or with a different or larger population and so my findings should be considered within this context. These limitations should also be considered when designing future research.

Implications for Further Research in GBL

While I hope this study is perceived as a worthwhile contribution to the literature, I acknowledge that it is just one contribution to the corpus of work within the field of game-based learning and that this study has limitations which I discussed in the previous section. There are, however, many unexplored avenues in the GBL field and I believe this study bolsters the argument that further research is warranted. Below I suggest five future lines of additional study.

This study showed that GBL can be successfully implemented in the field of elementary social studies. As there are still limited studies within this curricular content area and nearly none with this particular age-group, our first recommendation is for further study of GBL within elementary social studies. This study suggests that augmented reality games may have particular value in creating learning environments for history as it was often mentions of AR elements that

made this game “feel real” to participating students and as one teacher said, “brought history to life” (MC – T1). This study supports the assertion by Barton and Levstik (1996) that elementary history is better taught when it can be seen. With research suggesting that social studies continues to be marginalized and that many students do not find the subject relevant (Zhao & Hoge, 2005), I propose further study of GBL for social studies is a worthy pursuit.

Even though the findings related to learning outcomes in this study were mixed, one could argue that the general question of whether games improve learning has already been answered by other researchers (Hoffman & Nadelson, 2010; Gee, 2003; Prensky, 2001) and so further supporting research to simply bolster the efficacy of GBL would only be redundant. There is not, however, a substantial body of research supporting this assertion at the early elementary level for games so perhaps further research within this particular demographic and the curricular content area of history would be worthwhile. This consideration leads me to my second suggestion for further research: the development of better learning assessment tools to ascertain the efficacy of GBL in early elementary students.

As this study showed, teacher designed tests for early elementary students are often designed to test simple recall knowledge and with an expectation that all students will score well. While this is certainly appropriate for children of such a young age, it does make assessing the impact of an intervention on learning, such as this game, difficult by generating a substantial ceiling effect. Although the stealth pre and post-game assessments employed by this study were novel and garnered some useful data, they were not robust enough to generate the level of data required to be considered a comprehensive assessment tool. While I acknowledge others may find more success with teacher-designed tests or similar stealth assessments, I hesitate to encourage others to emulate these tactics and suggest that deep consideration be given to alternative assessment

strategies. Thus, my third recommendation for further study is to explore alternative learning assessment tools for early elementary GBL such as perhaps having students design the quests for the next level of the game or write a sequel story based on the game characters.

The findings from this study suggest that GBL can no longer be studied in isolation from that the entire curricular ecosystem if a deeper understanding of GBL is the objective. This was one of the first studies that examined the impact of GBL across an entire curricular unit and I found that there was indeed a ripple effect that extended well past the immediate gameplay. It therefore seems that GBL may in fact be best studied for its influence on multiple elements of the learning ecosystem, such as teacher's instructional practices, and not just on the learning outcomes derived solely from gameplay. This suggestion aligns with Squire's (2008) assertion that it is the context in which learners develop knowledge that is king," (p.16). Therefore, my fourth recommendation for further study is continued exploration of GBL within the full context of a curriculum; Does the implementation of GBL influence more than just the learning that occurs during gameplay?

My final and fifth recommendation for further study is a topic not previously addressed by this study – geospatial learning. While this study did not examine geospatial learning in young elementary students, the fact that students, with significant scaffolding, were generally able to learn how to read and navigate with a satellite map suggests that this type of learning, when presented within a GBL context, may be possible at this young an age. I therefore recommend further study of the relationship between geospatial understanding and game-based learning particularly for the subject of history.

I specify the subject of history in this recommendation because all historical topics are geo-referenced. History happens in physical spaces and places, and humans make historical decisions

(go to war; set up camp here; build our capital here) based on their perceptions of geography. Without geospatial awareness, history is even harder, and most young children lack this awareness (Barton, 1997). If a person has a developed sense of geospatial awareness, they are able to visualize the geography and locations around them, understand how those places physically relate to one another, and read a map. “People, natural objects, human-made objects, and human-made structures exist somewhere in space, and the interactions of people and things must be understood in terms of locations, distances, directions, shapes, and patterns,” (Downs & DeSouza, 2006, p. 6). Some examples of geospatial awareness include: a) The mountain I’m standing on is west of the ocean. b) To get to building A, I must go south on that street and then turn left (or east). c) It would take a long time to get to the village next to this one because it is many miles away. d) That river divides the town and makes some elements of daily life difficult. Understanding where “things” are in relation to where “you” or other things are is an essential skill for everyday life. Geospatial awareness (GA), however, is also particularly imperative for understanding history, and for some types of gameplay.

Augmented reality can help develop geospatial awareness by layering contextual information onto physical locations. This AR information can not only bring history to life and aid in students’ understanding of historical context, having students physically navigate historical spaces also allows for the development of their geospatial awareness.

While there have been several studies (Hong et al., 2009; Subrahmanyam & Greenfield, 1994) that have explored how video games can increase basic spatial awareness (the understanding of how objects relate to one another in space - the big picture), including one that specifically touted the value of *Tetris* (Okagaki & Frensch, 1994), there is a dearth of research that specifically looks at the efficacy of games to enhance geospatial understanding, the

understanding of the geography around oneself - the small picture. Tobler's first law of geography, that "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970, p. 236), establishes the importance of understanding this "small" picture. Fortunately, as Squire and Jan (2007) note, "games offer opportunities to tie goals to particular places" (p. 6), and AR allows us to give meaning to places. Hammond (2015) comes close to tying geospatial gains to game-based learning in a study that saw elementary students make gains in geospatial understanding during a curricular embedded game-like geocaching activity.

I hope that future scholarship in the field of game-based learning will consider these recommendations and build upon them.

Final Thoughts

While some of these findings are inconclusive, the full body of findings derived from this study support the assertion that CEGs within elementary classrooms are indeed worthy of continued study. Games can generate powerful experiences. I hope that this study has taken our field one step further toward a more fuller understanding of this power and how it can be leveraged within an elementary learning environment.

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GLOSSARY OF GAMES & GAME-RELATED TERMS

"In the zone": A phrase often used to describe being in a state of flow in which action seems to precede thought

Agent P's World Showcase Adventure at Disney World: An augmented reality game played at around Epcot's World Showcase

America's Army: A first-person shooter video game published by the U.S. Army intended to aid recruiting

ARIS: A computer platform for building Augmented Reality Interactive Stories. It is the platform used by this study to build the game for this project. More information can be found at www.arisgames.org.

Augmented reality: A technology that allows additional information such as images, text, audio, or sound added to a real-world view.

Carmen Sandiego: A media franchise focused on teaching children geography

Civilization: A turn-based strategy video game where the player is tasked with building a civilization

Club Penguin: A MMOG virtual world game containing multiple mini-games designed for children

Colossal Cave Adventure: A text-based adventure video game developed in the mid 1970's where a player explores a cave rumored to be filled with treasure

Dungeon & Dragons: A fantasy role-playing tabletop game

Edutainment: Games that use the entertainment value of games to promote learning. These games are often viewed, however, as "drill and kill" type games that children do not view as "real games".

First in Math: An online program that contains a series of math games. Players are rewarded with stickers and badges. It is designed to be implemented within schools.

First-person shooter games: A video game genre that focuses on the use of weapons from first person perspective

Flow: An enjoyable psychological state of being where a person is fully immersed in an activity, feeling energized and focused. Often characterized as being "in the zone". See Csikszentmihalyi (1990)

Gamer: One who plays games

GameSalad: A game development platform that does not require the use of code

Gauntlet: A fantasy-themed video arcade game popular in the mid 1980's

Go: An abstract table-top strategy game that originated in ancient China

GPS: A satellite-based geolocation system owned by the United States government. GPS stands for Global Positioning System

iBooks: An electronic book development software application produced by Apple.

Ingress: A geolocation augmented reality game produced by Niantic

***It's a Deal!*:** A game designed to increase intercultural communication

Leveling up: A phrase signifying advancement within a video game. When one advances to the next level in the game, one "levels up".

Magic Circle: A place where the player temporarily suspends their belief of the real world and all its laws and rules and adopts the "reality" of the game's world (see Klabbers, 2007)

MagiQuest: A place-based live-action role playing fantasy game where players take on the role of 'magi' and complete quests

Minecraft: A sandbox video game developed by Mojang and owned by Microsoft

***Missile Command*:** A 1980's video game developed by Atari where the player must defend their six bases from a missile attack

MMOG: Massively multiplayer online games

MMORPG: Massively multiplayer role playing online games

Monopoly: A popular board game where players attempt to bankrupt their opponents through the purchase and development of properties

Moravians: Colonial Moravians immigrated to America in the early 1700's from eastern Europe to escape religious persecution. In 1741, they established the town of Bethlehem, PA. In 1742, they established the school in this study. The Moravian Church, a protestant religious group, still exists today and is still affiliated with the school in this study.

Nintendo Switch: A portable video game console

Pac Man: A popular 1980's arcade game where the player must navigate through a series of mazes while trying to "eat" all of the "dots" before being captured by ghosts

Pandemic: A collaborative video game where players work together to cure a virus before it wipes the entire population

***Pitfall*:** A popular 1980's game designed for the Atari console where the player must navigate their character through the jungle avoiding predators and obstacles

***Pokemon Go!*:** An augmented reality game designed for mobile devices where a player tries to capture fantasy creatures called 'Pokemon' and defend or capture 'gyms'

Pong: A table tennis video game. It is one of the earliest video games ever developed

PS4: An abbreviation for 'PlayStation 4', a video game console produced by Sony

QR: Stands for quick response code. It is a graphic that when scanned by a mobile device's QR code reader produces additional information the screen of the mobile device.

Sandbox game: A sandbox game is an open, non-linear game where a player is free to roam, explore, and interact at will. These games, often played in "worlds", may provide some structure and objectives, but players do not need to engage in this proposed structure to successfully play and enjoy the game. While there may be classic "mini-games" available during play, there is often no clear "win-state" in the full game.

Serious games: Learning games that are designed to be more complex and intrinsically motivating thus creating opportunities for deeper and more meaningful learning.

Space Invaders: One of the earliest shooting video games where a player must destroy waves of alien invaders

Stencyl: A free game development software, considered easy to use, designed to create 2D games

Stratego: A strategy board game where players try to capture each other's flag

Super Mario Bros.: A video game created by Nintendo where the player tries to advance their character through a series of worlds to ultimately rescue the princess

***The Landlord's Game**:* A board game developed in 1904 by Elizabeth Magie. It was the inspiration for the board game *Monopoly*

The Lego Movie Videogame: An action-adventure video game produced by Warner Bros. based on *The Lego Movie*

The Oregon Trail: A video game developed in the early 1970's designed to teach school children about pioneer life on the Oregon trail. Multiple versions have since been released.

Tschoop: A historical figure from colonial Moravian history. He was a Mohican Indian chief who converted to Christianity. It is said he was the inspiration for James Cooper's book *The Last of the Mochians*.

Unitas Fratrum: Latin for "Unity of the Brethren", a phrase by which Moravians refer to their church.

WiiU: A home video game console produced by Nintendo in 2012. It is the successor to the popular Wii system.

Wizard101: A fantasy-themed MMORPG video game where players travers between various worlds while dueling various enemy creatures in a card-based means of play

XBox One: A very popular home video game console produced by Microsoft. It is the successor to the Xbox 360.

Xcode: An integrated development environment (IDE) utilized to develop software for Apple products.

APPENDIX A

GAME ATTITUDES QUESTIONNAIRE

Name: _____

Read each sentence.
Circle the face that shows how true that statement is for you.

	 YES!	 Yes	 I don't know	 No	 NO!
I know I could play a game like *Club Penguin* or *Minecraft*.					
I like learning with games.					
I like playing games.					
I can figure out the best way to play a game by myself.					

APPENDIX B

FLOW QUESTIONNAIRE

Directions:

1. **Think about the game you just played**
2. **Circle how much each statement represents how you felt playing the game today.**

	 YES!	 Yes	 I don't know	 No	 NO!
I was in the zone.					
I thought the game was hard but not too hard.					
I knew what to do in the game.					
I knew what I wanted to do in the game.					
I felt like I could get to the next level.					
The game kept my attention.					
I could do what I wanted to do in the game.					
I felt like nothing else mattered while I was playing the game.					
Time went by quickly while I was playing the game.					
I really enjoyed what I was doing.					
I would like to play this game again.					

NAME:

TEAM:

APPENDIX C

TEACHER-DESIGNED PRETEST

Name_____ Date_____

Use each word only once. Write neatly. Spell the words correctly.

Tannery	choirs	God's Acre	Grist Mill
Countess Benigna	Sisters' House	lovefeast	putz
Gemeinhaus	army hospital	Widows' House	Atlantic
Industrial	Count Zinzendorf	Bohemia	
Advent	Bell House	Moravia	
Brethren's House	Dec. 24, 1741	Monocacy	

1. From which two countries did the Moravians come? _____

   _____

2. Which ocean did they cross to the New World? _____

3. Who gave Bethlehem its name? _____

4. When was Bethlehem named? _____

5. Where did the single men live? _____

6. Where did the widows live? _____

7. Where did the single women live? _____

8. Where did the married couples live? _____

9. What is the name of the oldest building standing in Bethlehem today? _____

10. The Moravians divided themselves into groups called _____.

11. What was the Brethren's House used for during the Revolutionary War? _____

12. The place where the Moravians worked is called the _____ Area.

13. The early Moravians got their water from the _____ Creek.

14. The building where the Moravians tanned hides into leather was called the _____.

15. The building where the Moravians ground grain into flour was called the _____.

16. Who was Count Zinzendorf"s daughter? _____

17. The Moravian cemetery is called _____.

18. This is celebrated 4 weeks before Christmas. _____

19. This is the scene that tells the Christmas story. _____

20. The church service in which Moravians share buns and coffee together is a _____.

APPENDIX D

TEACHER-DESIGNED POSTTEST

Name _____ Colonial Moravians

1. In which European countries did the Moravians originally live?
_____ and _____

2. What are these countries known as today? _____

3. List two reasons why the Moravians came to America.
>_____
>_____

4. The Moravians were called _____ because they taught others about God.

5. Who was the founder of Bethlehem? _____

6. Who gave Bethlehem its name? _____

7. When was Bethlehem named? _____
(month) (date) (year)

8. Describe the first house.
It was made of _____. It had _____rooms.
One room was for _____ and the other room was for
_____. It stood where _____
stands today.

9. List in order the three places where the Moravians worshiped.
>_____
>_____
>_____

10. Colonial Moravians did not live together as families. Instead, they lived in groups called _____.

11. Where did the married couples live? _____

12. Where did the single sisters live? _____

13. Where did the widows live? _____

14. Where did the single brothers live? _____

15. What color ribbons did these people wear?
>child--_____
>single woman--_____
>married woman--_____
>widow--_____

16. List three buildings located at the Industrial Area.
>_____
>_____
>_____

17. What animal is in the center of the Moravian seal? _____

18. _____ is the Moravian cemetery.

19. The song service in which food such as cookies and juice are served is called a _____.

19. The Moravians decorate their homes and churches with a _____ to tell the story of Christmas.

20. During Christmas Eve services Moravians hold lighted _____.

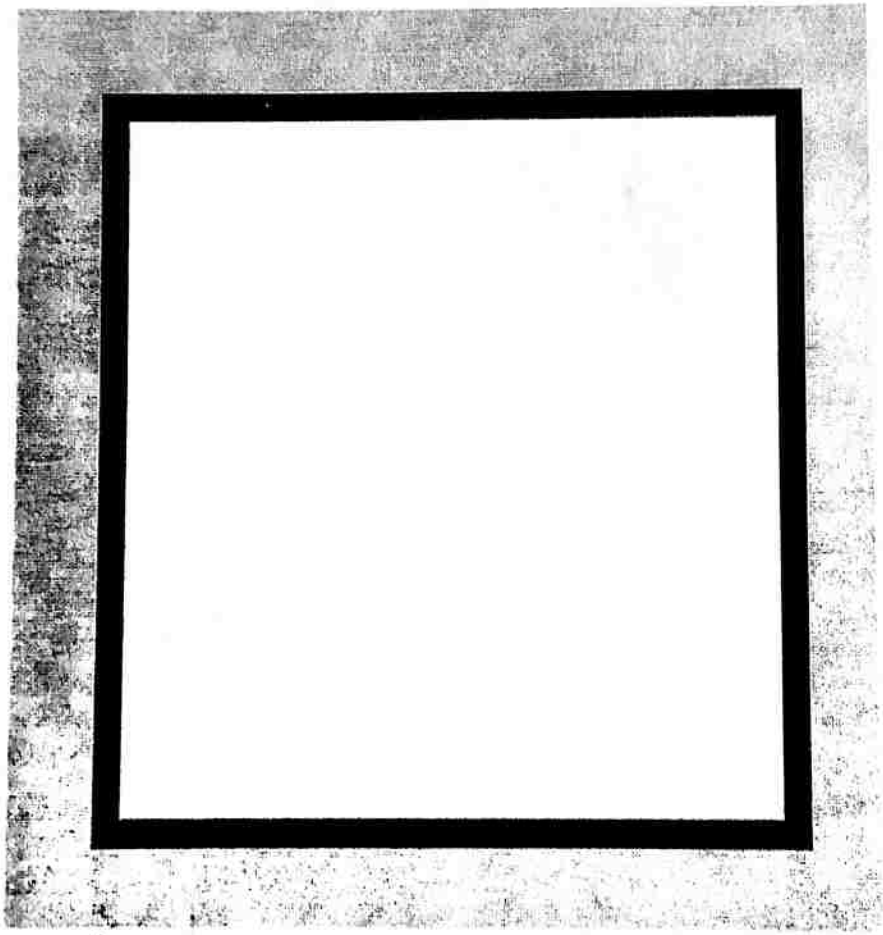
21. The four weeks before Christmas are called the season of _____.

22. The early Moravian Church was known as "Unity of the Brethren." What is the Latin name for "Unity of the Brethren?"

_____

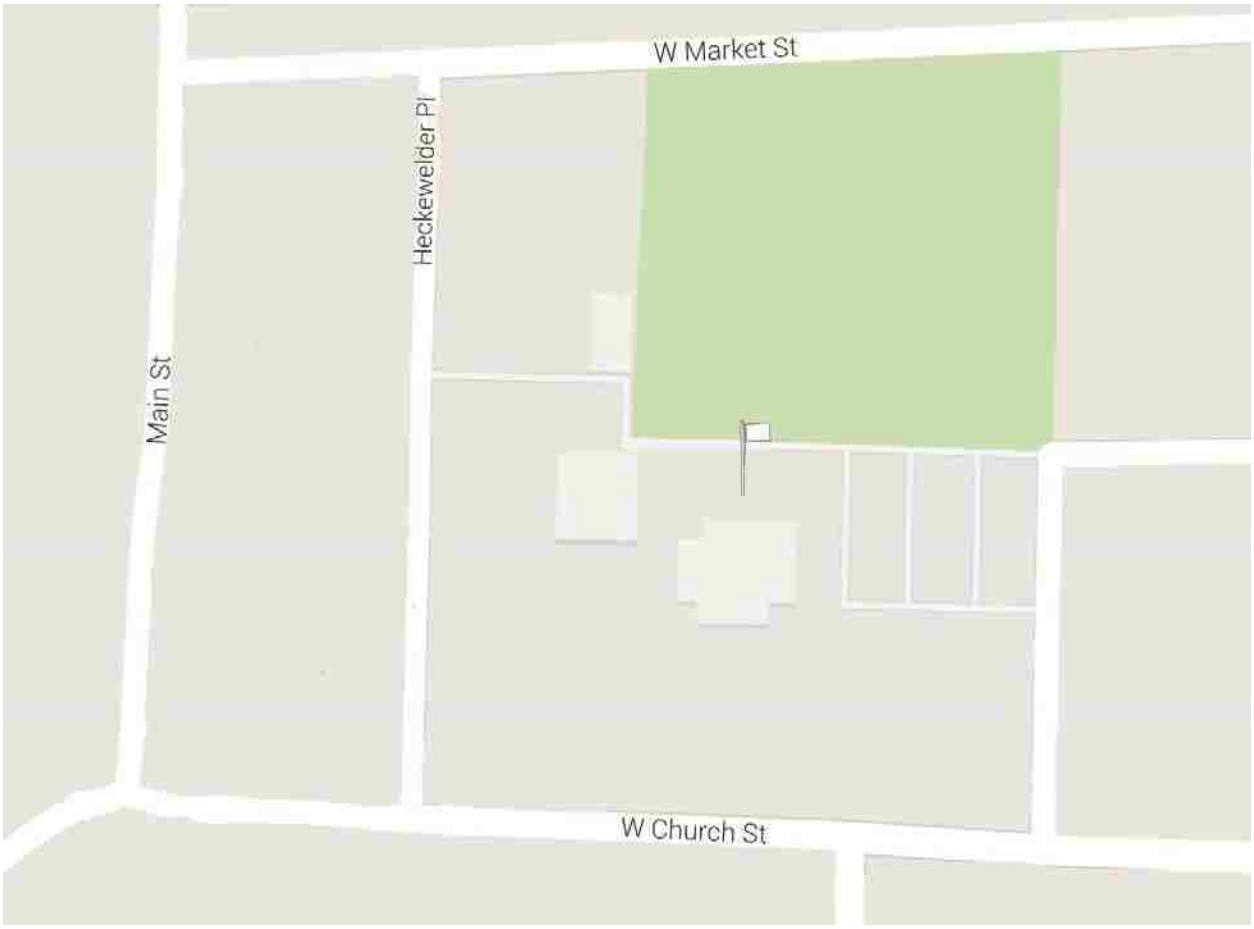
This is a picture of my favorite part of our Colonial Moravians study. It shows _____

_____.



APPENDIX E

MAP ACTIVITY



APPENDIX F

STUDENT INTERVIEW GUIDE

Year	RQ	Question
1	1	What do you remember about liking about the game?
1	1	Tell me what it felt like to play this game.
1	1	Do you wish you could have played longer, shorter, or was it just enough?
1 & 2	1	Did you feel the game was easy, medium, hard, or just right?
1 & 2	2	Do you think this game helped you learn about the Moravians?
1	2	Can you tell me some things you learned about the Moravians from the game?
1 & 2	1 & 2	Do you think this game helped you remember things for your test?
1 & 2	1	What would make this game better?
1 & 2	1	If you could play it again, would you?
1 & 2	1	Would you prefer to play it with a friend or by yourself?
1 & 2	1 & 2	Do you think next year's second grade should play this game in their Moravian unit?
1 & 2	1 & 2	Do you think games could be used to learn other things in school?
2	1	Can you describe what it was like to play this game?
2	1	Tell me what you were feeling while playing this game.
2	1	What did you like about the game? What did you not like?
2	2	What can you tell me about the Moravians?
2	2	How is your life different than the Colonial Moravians?
2	1 & 2	If we made a game about your life, how would it be different than this game?
2	1 & 2	Do you remember any times when you or other students talked about the game in class?
2	1 & 2	What did you think about the map in the game?
2	1 & 2	What would you think if ALL learning in school was done by playing games?

APPENDIX G

TEACHERS' DEBRIEF GUIDES

Year 1
The teacher will conduct this debriefing discussion with the class following gameplay sessions. The topics below are suggestions. The teacher may adjust as appropriate.
The researcher will observe and record the discussion for transcription and analysis.

Topic 1: Game Experience? (RQ1)
- Describe your experience playing the game
- Describe parts of the game that you liked or didn't like
- How did you feel playing the game?

Topic 2: Learning? (RQ2)
- What are some things about the Moravians or their community that you remember from the game?
- How did this game help or not help you learn about the Colonial Moravians?

Year 2
After the students play the game, the teacher will lead the class in a short debrief session (about 15 mins). Below are some suggested topics and questions the teacher may use, however, they are only intended to be starting points. The teacher should lead the discussion in the direction she feels is most valuable.

Topic 1: Game Experience? (RQ1)
- Describe your experience playing the game
- Describe parts of the game that you liked or didn't like
- How did you feel playing the game?
- Do you think this game helped you learn about the Moravians?

Topic 2: Learning? (RQ2)
- What are some facts about the Moravians or their community that you remember from the game?
- Can you describe how your life is different than that of the Colonial Moravians?
- What was important to the Moravians?
- Can someone describe how the Moravian community was organized?

APPENDIX H

TEACHER INTERVIEW GUIDES

Year 1 – Post-game

RQ	Question
ALL	Overall thoughts?
2& 3	What worked well or not well?
2 & 3	What impact did this activity have on the Moravian unit as a whole?
2 & 3	What do you think about having kids paired up?
2 & 3	What could make this activity better for future classes?
2 & 3	Talk about how different types of kids responded to this activity.
All	Do you have any additional thoughts you'd like to share?

Year 1 - Post-unit

RQ	Question
ALL	Now that the Unit is over, what are your thoughts about this gaming experience?
ALL	Describe your thoughts about this project before we started compared to now.
2	Comparing this year's students to previous years' students, did these students meet or exceed or fall below your expectations when it came to the Moravian History unit?
2 & 3	How do you see this type of gaming experience fitting in with this Unit in the future?
3	Has this experience influenced your thoughts about a) game-based learning, and b) how to teach social studies?

Year 2 - Pre-unit

RQ	Question
3	Tell me about the history of the Moravian History unit.
3	How has it evolved over the years?
2 & 3	Have the students changed and has that influenced your approach to the unit?
ALL	Now that some time has passed, what are your thoughts about the whole experience last year?
2 & 3	Have your thoughts about games for learning changed over time?
3	How do your thoughts about the unit compare to last year's at this time?
2 & 3	What role do you think the game might play for the kids/you?
2	What do you hope the kids will learn?
3	What (if any) adjustments do you think we should make when playing the game this year?
3	Have you thought about using games more in other areas of instruction?

Year 2 - Early Unit

RQ	Question
3	Have you thought about the game while teaching the unit?
2	How do you think the students are doing with learning?
3	Can you talk about the activities within book? How you use each use them with your classes?
3	Can you talk about the activities beyond the book? What are they and how do you use each use them with your classes?
ALL	What do you anticipate the reception of game will be?
2 & 3	What do you think the impact on your teaching and the students' learning will be after we play the game?

Year 2 - Post-game

RQ	Question
ALL	Overall thoughts?
ALL	What worked well or not well?
ALL	Addition of recording answers?
2	Have you noticed any initial impact of the game with your students now that they've played it? How have the responded?
3	Have you noticed any impact of the game on your teaching the unit now that the kids have played it?
2 & 3	How do you think the pairings worked?
2 & 3	What could make this activity better for future classes?
2 & 3	Talk about how different types of kids responded to this activity.
ALL	Do you have any additional thoughts you'd like to share?

Year 2 – Pre-test

RQ	Question
ALL	How do you feel the unit has gone so far this year? Any thoughts?
3	Have you found the game or gameplay experience has impacted your teaching at all?
2 & 3	Looking at the unit as a whole, were there any topics, chapters, or activities that worked particularly well or didn't work as well as you'd hoped with this group?
2	Do you have any predictions regarding how your students will perform on the unit test?
1 & 2	How, if at all, has the gaming experience impacted your students' beyond just the gameplay day?
ALL	Do you have any additional thoughts you'd like to share?

Year 2 - Post-unit

RQ	Question
ALL	Now that the unit is over, and the tests have been graded, how do you think this unit went? What went well? What didn't work?
ALL	How did this unit go compared to last year? Compared to previous years?
ALL	Now that the Unit is over, what are your thoughts about this gaming experience?
2	What are your thoughts about the gaming experience's impact on learning?
3	What are your thoughts about the gaming experience's impact on your teaching?

2	What did the game provide or do that helped with learning?
2	What did the game do that distracted from learning?
2 & 3	Can you talk about how different types of students responded to different types of instruction? How does the game "fit" with different types of learners?
3	Describe your thoughts about this project before we started compared to now.
3	How do you see this type of gaming experience fitting in with this Unit in the future?
3	Has this experience influenced your thoughts about game-based learning?
3	Has this experience influenced your thoughts about how to teach history?
3	Has this experience influenced your thoughts about how to teach other subjects?

APPENDIX I

STEALTH INTERVIEW QUESTIONS

Question Number	RQ	Question
Pre-game 1	2	Can you tell me 3 ways the lives of colonial Moravians were different than your life is today?
Pre-game 2	2	Can you tell me the names of 2 important colonial Moravians?
Pre-game 3	2	Can you tell me 3 interesting facts about colonial Moravians?
Post-game 1	2	Can you tell me 3 ways the lives of colonial Moravians were different than your life is today?
Post-game 2	2	Can you tell me the names of 2 important colonial Moravians?
Post-game 3	2	Can you tell me 3 interesting facts about colonial Moravians?

APPENDIX J

QUALITATIVE ANALYSIS CODES

RQ1 - Level 1 Codes:

about half would like to play alone next time
assuming a role in game
Being active good
better with a friend
chickens were fun
didn't like it because it was easy
Didn't like taking turns with iPad
difference between GBL and traditional learning
Different partner would be faster
Difficulty - Medium Hard
Difficulty - Medium is good
difficulty just right
emotional response to game
empathy for Game character
Enjoy history
enjoyed chasing chickens
enjoyed collecting and returning
enjoyed collecting apples
enjoyed collecting keys
enjoyed finding out about girl and house
enjoyed finding people
enjoyed having partners
enjoyed learning
enjoyed learning how to navigate
enjoyed learning in game
enjoyed map
enjoyed navigating
enjoyed solving problems
every child had fun
Excited to share with friends
excited with leveling up
Failing at too hard games
feeling active (fun)
feeling confident
feeling curious
feeling empathy for game character
feeling excited
feeling excited & active
feeling excited and confident
feeling excited playing
Feeling Excited playing game
Feeling focused
feeling fun
feeling happy
feeling happy to help game character
feeling hot while playing
feeling in the zone
feeling in the zone - won't remember stuff
feeling like going back in time
Feeling like I was in the game with them
feeling like in a dream
feeling like they were in the game
feeling like they were IN the game
feeling like they were learning more on day 2
feeling like they were the GPS
feeling proud of gaming progress
feeling singularly focused
feeling successful
feeling time pressure when chasing chickens
Feeling tired (good) and excited and fun
feeling tired (hot)
feeling tired but good from activity
feeling frustrated when map didn't work
felt medium while playing
felt real
felt so real
filling in story gaps
finding chickens was cool
finding things was hard sometimes
Following others in game
friends can help when playing
Friends can help with game
frustrated when couldn't figure out quest
frustrated with map
frustrated with sharing
frustration can't figure out quest
frustration with partner
Fun
Fun and Active
fun being active playing game
fun being outside, active, finding clues
fun both times
Fun chasing, leveling up, collaborating with others
fun leveling up
fun playing game
Fun to find places; praying quests
Fun to share progress with partners
game came to life
Game character seemed out of place
Game could have been harder
game difficulty just right
Game easier alone
game easier faster with teammate
game food made him feel hungry
Game fun for others
Game good for people who don't like learning
Game good for people who don't like to learn while gaming
game image was cool
game is fun
Game medium hard
Game pretty fun
game pulled in kids that normally aren't engaged
Game really fun; tiring (good)
game that isn't fun isn't a game
game was a little hard
Game was easy
game was fun
game was fun but wish had more time, it was hard
game was hard
Game was medium - easy
game was medium hard
Game was really fun
game would not have been fun at end of unit when they knew everything
games that don't work are not fun
gaming turned learning stuff into a story
grave quest hard
gravestone quest hard
had fun
had fun playing
had trouble finding stuff
happy playing game
harder is more fun
harder more of a challenge
Having fun
Having fun playing game
having partner made game easier
having trouble with map
Images seemed real
Immersed in game
interacting with game as if it were real
interacting with game characters
keys quest hard
kid better at peer scaffolding because he was having fun playing game
kid in the zone with ipad
kids conversing with Game Characters; brought content to life
kids excited about game
kids good at map
kids like collecting things, some trouble spots, liked challenge, liked learning, being outside, burning energy
kids loved being active
kids loved doing something typically they can't (ie. run through campus)
kids using map skill
kids using map skills
kids were excited by game
kids were focused
kids were really using map
Learning didn't feel like learning in game
like being active
like playing with others
liked "talking" to game characters
liked being active
Liked being active in game
Liked being outside
liked challenge
Liked chasing chickens
liked chickens
liked collecting apples
liked conversing with game characters, finding things
liked finding chickens
liked finding different places/things
liked finding game characters
Liked finding stuff
Liked finding Tschoop quest
liked game
liked going outside
liked going places and following clues
Liked going places in game
liked going to places and collecting
liked grave quest
Liked learning about own school

liked learning in game
liked length of quests
Liked map
Liked moving around
liked playing with best friend
liked quests
liked quests and stylus
liked the blue dot
liked using map, active
liked working with partner to solve puzzles
Likes medium hard games
lost sense of time
loved game
loved game; being outside
Loved playing game
Map easy
Map got easier
Map hard
Map made game easier
map not working
map was challenging
map was confusing
Map was frustrating
map was hard
map was hard; others helped with map
map was medium
Map was medium hard
Medium - Hard
Medium difficulty
Medium hard good
Medium hard ok
more focused with iPad than w/o
more fun not alone when playing game
more fun with friend
More fun with others; can help each other
More fun with partner
more kids like partners
no fear of failure
Not aware of learning while playing
one quest too hard
others should play
Others would find this fun
Others would like game
partner can help with game
partner easy
partner experience dependent upon partner
partner medium
Partner took too long to find things
partner was a little hard
partner was medium
partners was easy
partners were distracting
Playing alone would be faster
playing with others more fun and help
Playing with partner more fun
prediciting this year's kids will love game
prefer having teammate to play game
prefer playing with friend - collaboration
Prefer playing with partner
prefer playing with team
prefer to play game with teammate
Prefer to play with friend
Rather play alone
rather play with friend
role playing
Running campus around is fun
Running to do more in game
saw quests as little games
sharing is hard
sharing was frustrating
sharing was ok
sharing worked
some map trouble
Song in head while playing
stealth worked
Still excited after playing game
student more focused with ipad
taking turns is problem in game
talked about game later with friends
talking with friends about fun game
teammate is company; more fun
teammates are funny
Teammates can help
Think others should play
time goes fast
Tired from running around (good)
too easy would not be fun
too hard would be bad
too much running (pressure to hurry)
trouble with other players
Trouble with quest
trying to relax with chicken time limit
want the game harder
want to expand game
want to play again
Want to play alone - play faster
Want to play everyday
want to play longer
Wanted game a little bit easier

RQ1 - Level 2 Codes:

Being Active is Good
Challenge
Embracing challenge
Enjoyed searching
Enjoyment while playing
Excitement
Feeling confident
Feeling curious
Feeling like a real game
Feeling need to run/time pressure
Focused while playing
Game feeling real
Game not feeling real
Game was easy
Game was hard
Game was medium
Game was worthwhile
Importance of fun
Importance of right level of challenge
In zone while playing
Interactions with partners important
Like being outside
Liking game elements
Liking partner play
Lost sense of time
Map was good
Map was hard
Map was medium
No fear
Normal rules don't apply
Playing difficulties
Prefer to play alone
Sense of accomplishment
Wanting to play again

RQ1 - Level 2 Codes:

Both - Facilitating factor
Both - Interrupting Factor
Flow - Barrier
Flow - Facilitating Factor
Flow - In Indicator
Flow - Out Indicator
In Flow & Inside MC
In Flow & Inside MC
MC - Facilitating factor
MC - Inside Indicator
MC - Rejection Indicator
Out Flow & Inside MC

RQ2 - Codes:

Code 1 - General Learning

3 more names
Asperger's kid more involved
book vs game
Bringing game to class discussion
excitement about remembering obscure fact from Game
field trips --> helping with book learning
game --> additional inquiry
game --> gave kids background knowledge
game accommodated all types of learners
game gave info not previously known
game helped me remember stuff but not for my test
game helped remember stuff
game images helped Ss remember historical figures
game might help remember
game was "Comenius-like"
game will help them remember
guessing to figure out key order
hoping game will help with retention
kids ahead of curriculum from game
kids don't realize they're learning when gaming
kids referring to game in class discussions
kids referring to game in class discussions
knowledge learned in game empowered constructivist learning
knowledge learned in game empowering constructivist learning
liked figuring out problems
making meaning
New name (Huss)
pairs helped learning
pre-game curiosity about unit
prior knowledge
prior knowledge
question from game - what's a widow?
Remembering 3 keys quest
remembering game
think there will be better retention
traditional vs game
unit --> additional inquiry
Unit developed to teach facts
Using prior knowledge
vacation interrupts learning
want to learn
won't remember because so into game

Code 2 - RQ2A - Learning for Mastery

1741 year Bethlehem was founded
Advent
animal on the seal
answering quick Q&A's
answering review Q's with clickers
Atlantic Ocean
beeswax is pure
bell house
bell house = married
Bell House, Sister's House, Brethren's House, Hotel B was first House, Sister's House. Jon Huss
Benigna started school
Best test scores this year (2)
Bethlehem named in 1741
boys/girls different schools
Boys/girls lived separately.
Bretheren hospital
bretheren house
Bretheren's Choir
Bretheren's Hospital
Building names
CC built 3rd
Central Church, Old Chapel
children separated
Children worked in choirs
choir houses
Choir system
Choirs
choirs not singing choirs
choirs not singing choirs, kids separated from parents, choir houses, Bell House, Old Chapel
Christains in God's Acre
church everyday
Comenius
count zinzendorf
Count Zinzendorf
Count Zinzendorf, Countess Benigna
Count Zinzendorf, Countess Benigna, Tschoop, Heckewelder, Nitchman
Count Zinzendorf, daughter...?
Count Zinzendorf, Huss
Count Zinzendorf/CMC
Countess Benigna
Countess Benigna started school
define choirs
define discontent
define missionary
define widow
defining discontent
diff b/w musical choir and living group choir
different ribons for girls/women
don't mix up Moravians/Pilgrims
everyone worked a job
everyone worked a job, boys separate from girls
families did not live together, no electricity
finding Bell House on Map
finding Gemine haus on map
Finding God's Acre on map
Finding Hotel B on map
finding industrial areas on map
finding Old Chapel on map
finding Sister's house on map
First House Details
first house where HB is
First House where HB is, logs
First House where Hotel Bethlehem is
frist house on spot of HB
game helped with geographical understanding
Gemeinhaus
God's Acre
Got water, first house green, Hotel B where first house was
green wood
Heckewelder
Heckewelder and Nitschmann
Heckewelder St
Hotel B was first house
Hotel B where first house was
How Lot system works
Hus burned
Hus killed
Hus was burned
Identify CE Building
identifying GA
indian in graveyard
Indians part of Moravian community
industrial area
Industrial area/Heckewelder
John Amos Comenius, Count Zinzendorf, Tschoop.
Jon Hus
kids and parents had jobs, candles for light
kids away from parents
kids did well on test
kids performed below expectations on test (due to interruptions)
kids performed better on test than preceeding year
kids taking parents on tours
labeling map
Lamb
lamb on seal
lived communally
lived communally, lots of work, choirs
lived in different groups, boys/girls did different things
lived in groups
lots of chores
M's from german speaking place
M's wanted be missionaries
mapping buildings
married wore blue
missionaries
Missionary definition
Missionary does religious work
missonary teaches bout god
mixing up buildings
Moravia
Moravia Bohemia
Moravian & Bohemia
moravian indian buried in GA

Moravian origins
moravians belived in God
Moravians came from Europe
Moravians came to America to be missionaries
Moravians founded school
moravians from Germany
moravians from Moravia & Bohemia
Moravians lived in choirs
Moravians pray
Moravians weren't free to worship in Europe
Ms arrival in USA
Ms used candles
Name 3 places of worship
name zinzendorf, hus, moravians had chix
named places of worship in order
named Zinzendorf
naming buildings
naming bulidings on map
naming bulidings on map
naming different choirs
Nitchman and Zinzendorf
Nitchman founded Bethlehem
nitchman named bethlehem
No electricity
no electricity, boys & girls separated
No electronics or electricity
no electronics/cars, kids not with parents
not knowing missionary
Old Chapel
Old chapel built 2nd
Old Chapel, Gemeinhaus
oldest to newest houses of worship
pray a lot
Prayed in old chapel
Prayer important
Putz
remember lamb from game
remember seal
Remembering main facts
remembering names
Ribbon colors
Saal
Saal built first
Saal was first place of worship
Schnitz House
Schnitz is dried apple
single sisters
Sister
Some lived in Choirs
Tchoop
telling parents dates, details, seal
they were missionaries, believed in God, didn't live with parents
think Ss will do well on test
True/False game
Tschoop
Tschoop buried in God's Acre
Tschoop in graveyard
Tschoop the indian, Hotel B was First House
Tschoop was an indian
Tschoop was an Indian and a Moravian
Tschoop was indian or African American
Tschoop's grave
Unitas Fratrum
vespers candle
we don't have choirs, we have tech - they don't
weaker test takers did well on test
what a missionary does
what a missionary is
what are colonies
what are states
what is a choir
what is a missionary
what is a putz
what is a widow
What is discontent
What is God's Acre
when bethlehem was named
who is Comenius
who is zinzendof
why M's came to america
Widow
wrong ribbon color
year bethlehem was founded
Year school was founded
Zinzendorf

Code 3 - RQ2B - Learning for Exposure

"stranger"=not moravian
2 Bethlehems in the world
advent calendar
advent details
Bell House details
Bethlehem is the Chrismas City
Bethlehem star
bishop
Bishop Etwine
blacksmith work very hot
Boarding schools
boys & girls did same things
boys had class at night
boys wore breeches/socks
boys/girls different chores, prayed upstairs, animals on one side of house
brass instrument
buried by choirs
burned heretics
candle represents Christ
candles for light
Central Church details
cleaned a lot
clothing different, fires, handmade everything, rigid life
clothing recycled
Colonial period was a long time ago
colonials lived 200 years ago
comenious wrote moravian beliefs down
Comenius educate boys and girls
comenius provided money
Comenius started a school - everyone gets educated
comenius statue - recognized because of equality in ed
comenius worried church would not survive
Community living norms
Cooked over fire
correctly drew moravian woman with correct dress
could locate Tschoop's grave
cut wood for Gemeinhaus so it wasn't green
deeper understanding of missionaries
compared to Trad learning
deeper understanding of Missionary
define arithmetic
define astronomy
define occupation
define sacred
define scarce
define social studies
define unique
defining colonies
defining occupation
definition of plight
definition of pure
describing blacksmith work
describing gravestone
Desire for economic change
detail on music stand
details about tschoop
Details of Bell House
Details of Brethren's house
Details of Grist Mill
Details of Monocacy Creek
Details of Old Chapel
Details of sister's house
Details of Tannery
Details of Waterworks
Detals of First House
Didn't do everything by themselves, participated in Rev War, lots of clothes
didn't have a lot of money but could make a lot
didn't have electricity or tvs
differences b/w our school day and moravian school day
different kinds of putzes
different kinds of putzes
Different occupations
different occupations, blacksmith repaired horseshoes, baker baked food
Different toys
Discontent defiinition
Discontent with Choirs
Dye House details
Economy changed
electricity from monocacy creek
Electricity from Monocacy Creek, roofs from clay
everything made by hand, didn't pay for things
evolution of churches
fewer buildings backthen
Finding Hus grave
finding Schnitz House & Nain House on map
first house on main st
First settled PA in Nazareth
First setttled in GA in US
flat graves because equal

flat graves in GA
found Tschoop's grave (post game)
Friends with Mohicans, played
game interactions led to deper understanding of religous work
gave Tschoop christian name
gender determined job
gender roles
George Washington prayed at OC
girls cooked, set table
Girls wear pants now...everyone gets education now
god made their decisions - lot system
God's Acre definition
God's Acre details
God's Acre is north
got electricity from creek
green lumber process
had to build bigger churches because community grew
had to wake up at 6am
holy roman empire
how nisky cemetary is different than GA
how to build a putz
how to make flour
How to spell Tschoop
Hus burned because he liked his religion
Hus sacrificed life
Hus wanted to pray his own way - Roman king said no
Hus was burned
I go to sleep earlier
identified buildings without much scaffolding
identifies Tschoop image
identify boys skills
identify Europe on map
identify first house painting
identify girls skills
identify sections of god's acre
identify Tschoop's grave
identifying strangers row
Indian had 2 names
Instruments found in Moravian society
job to collect wood, like me
Kids had jobs
kids played games
knowing who comenius is with prompting
lamb is God
listing all the building in industrial area
lived communally
lived in boarding school, they shared everything, we don't
living together --> illness spreads
locate Tschoop's grave
lot system is random
Luck system (lot)
M's diet
M's left Georgia because of Rev war
M's not segregationists because idian girls
lived with single sisters
made clothes
made toys out of sticks and other things
make a lot of things
Map of whole area
minister does religous work
missionaries learn mohawk language
Missionary turned Tschoop into christian
missionary work with indians
Mohican
Monocacy creek
Moravian Academy founding
moravian customs we still have today
Moravian daily life
moravian did missionary work in the carribean
moravian life has changed
Moravian occupations
Moravian prep
moravian society chaged becaue feelings changed
Moravian star at bell house
Moravians abandoned choir houses
Moravians did not socialize between men/women
Moravians didn't have electricity
moravians didn't have school right away
Moravians don't believe in violence of Rev war
Moravians exist today
moravians held to beliefs
Moravians helping soldiers
Moravians hid to avoid persecution
Moravians slept on hay beds
Moravians wanted to live together
Moravians were "bossed around"
Moravians were nonviolent
More trees back then (?)
morvians non-violent
Ms got food hunting/farming
music part of Moravian culture
music room in Gemeine haus
music stand for 4
Nain House
Nain house = Native Americans
Nain house for Heckewelder & Indians
Nain House/People who worshiped at OC
name of John (Tschoop)
Neisser school for boys
No Colonials today
no electricity, school longer, no gadgets
no electronics, different clothes
no grocery stores
no gun powder
No iPods
no longer make schnitz in house
no paper, no cars
No Yachts
non-moravians = strangers
not know name of ships
not knowing Comenius
not much money - made stuff and sold it to others. Didn't keep stuff for self.
not much tech
organization of GA
Others were converted into Moravians and buried in God's Acre
Our life is different...
paper catches wax
parts of putz
pathways seperate GA sections
Patriotism doesn't mean you have to fight
pilgrims were persecuted
Polly dolls
Power from Monococy Creek
Praying like a hobby
quilts from old clothes
Read Moravian seal in German
Reading graves
realizing today's buildings were same as back then
realizing today's space has changed over time
recalling textile shop
red for christ's blood
red paper = blood of christ
religious persecution not fair
Religous beliefs stayed dudring discontent
remember other historical figures
remembered Comenius with prompting
remembering more buildings
remembering more buildings is advanced
Remembering Nain House
remembering name Heckewelder
remembering strangers row
roofs out of clay
rugs from rags
same time as Revolutionary War, fire in Central Moravian Church
sawmill cut wood
school for 11 hours, alcohol for medicine
school for 9 hours
school important because it was for everyone
school was important because it was started the year after town founded
segregation
shouldn't step on graves
Some lived in boarding schools
spelled SAAL
spinning wheel
stone triangles to hold up houses
Stopped living in choirs
Stopped living in choirs to see families
Subjects taught in school
tannery made leather
Their school day schedule was different
they sell stuff, we don't. we keep it.
time lapse b/w founding of Bethlehem & Rev war
trombones scared indians away
Tschoop buried in A section
Tschoop buried in GA, named John
Tschoop buried in section A, God's Acre
Tschoop grave location
tschoop is in God's acre
Tschoop pronounced Job
tschoop was a drunkard
Tschoop was one of the first Indians that turned into a missionary
tschoop's christian name
Tschoop's christian name is John
Tschoop's grave location
Tschoop's gravesite
Tschoop's Indian grave - new pronunciation of his name
Tschoop's name was John
unfairness of lot system
uses for leather
vesper candle paper
violins
wash clothes
water for power
Waterworks details
We don't pray as much as moravians
we don't worship as much as moravians
We have electronics, they did not
we have shorter school days, not as much work

We have tech, Moravians did not
Wear hats
wear same clothes every day
weaving
what does gemeinhaus mean
What happens in the Schnitz house
what is a blacksmith
what is a quarter hour
what is a tannery
what is an estate
what is green wood
What is mill for
what is religous work
What is religous work
who was polly Heckewelder
why would M's learn german
Women & Men can hardly talk to each other
wooden shoes
wool from sheep
yokes for water, candles for light bulbs, farming, sharing econoomy
Yokes to get water, no hydrants
Zinzendorf paid for ships
Zinzendorf said all should learn, strict about choir houses

Code 4 - RQ2B - Learning Beyond the Curriculum

a lot more trees, fewer buildings
central church was last built because it looked newer
Chickens escaped
deeper connection to history
Deeper knowledge about other figures (GW)
deeper understandings
defining sexism
did not invent smart boards
different president, more trees back then
Find buildings on a GPS map
George Washington
George Washington & John Adams in Old Chapel
George Washington in Old Chapel
george washington prayed in old chapel
geospatial understanding improved
God is the vine
GW sat in Old Chapel
GW went to Upper School
John Adams was JQAdams' father
know why they built bigger and bigger
learned to navigate
Martha was George Washington's wife - John Adams, & JQAdams also visited the Old Chapel
Martha Washington in Old Chapel
might have had bikes
moravians prob had farms (chickens)
More you use the map, it helps you
Nain house was moved
needed lots of help
No grocery stores
No indians right now
not many doctors then
Revolutionary war
Ribbons --> sexist
there are different types of moravians
using map to find stuff
Washington creating a chapel, chickens everywhere
we have better jobs, no more indians around here anymore
We have cell phones, they don't

Code 5 - Proximity of Data to Gameplay

Before
Close
Medium
Far

Code 6 - Game-related or Not Game-related

Yes
No

RQ3 - Teacher Practices & Decision Making

Level 1 Codes:

1st year, after unit, thinking maybe putting game more toward end so students could see purpose of what they've learned (as a reinforcement)
30 years ago wanted to learn about school history and Moravians so developed book as basis for unit
active better than transmissive learning
active learning better than passive
activities "extend" the reading - extend the learning process
activities during class time almost always with partner
activities initially designed for fun but ends up being good reinforcement
after unit, still liked game being in middle
anticipate kids will love game
assessment beyond test
before game, didn't talk about GW much
book activities are fun...but Game is fun AND moving around
book activities done often during independent time
break up hard/tedious stuff with activity
cameras providing student agency - their point of view
changed word scramble to tactile, team activity

changing activity based on struggle of last year's students, not because of researcher's presence.
classes do activities together, teachers team up
clickers is just a quiz game
combining learning goals - want them to learn tech and learn about moravians
connecting GBL to Comenius
connecting reading to other sources of information
content hasn't really changed...but the presentation a little..game big new dimension
could use games for Japan unit
could use games for Map unit
did not think about GBL before this experience
do reading/discussion first, then if time activity
do stress certain facts that are key
do use clicker game...
Does the unit test "ask too much"?
each year, do something a bit different
expectations on what kids should learn hasn't changed
game --> gave kids background knowledge --> helped with enthusiasm. History can be dry
game --> more open view
game "carried" kids through the unit
game actually brought history to life - active vs passive
game after initial unit intro is best case scenario
game allowed kids to give more input when working on book together
game allowed kids to give more input when working on book together
game empowered kids with knowledge - opposite of transmissive learning
game experience aligned with teacher dev push to "create innovators"....as opposed to the way it's always been done for the last 100 years
game generated excitement for whole unit
game helped in and out of classroom
game influenced shift to more systemic thinking emphasis
game influenced teachers' use of teams in other activities
how to use GBL in other subjects
impact of breaks on learning
importance of doing activities beyond textbook - get them all involved
Integrate knowledge across subjects - tying things together helps them stick
intentionally didn't teach map until after game
intro of cameras helps keep kids involved
keep Comenius, learn through play, in mind
kids expressing curiosity = learning
kids more interested in tour after just playing game
kids referencing things from game - teacher saw as more reps good for remembering
letting kids increase importance of Nain house
letting student make choices in photography
liked 2 kids with adult setup
liked adding a new modern element to curriculum
liked connection of maps unit with Moravian game
liked game being in middle of study
Liked having game near beginning of unit - got kids excited
liked having it near Museum visit, got kids excited, brought unit to life
liked having partners for weak readers
liked kids having some preknowledge before playing game
liked timing of game - game drew them in
liked timing of having game after some initial instruction/field trip
little kids = hands on
lot system game is more of a real game
love GBL just worry about time
more confident with game 2nd year
more positive opinion of GBL
nervous about kids near busy street
never played games before - game experience exceeded expectations
not opposed to GBL but concerned about logistics
observed deeper understandings
observed kids that want to be "in charge" doing same in classroom and with game
observed more interest in discussions
Ok with stuff not working sometimes
paired gamers with non-gamers
planning - adjusting on the fly to each class
planning the initial unit thought process
planning to do photos and essays
positive perception of GBL after playing this game
preserving game experience pre-game
pulled game into class discussions

pulling game experience into instruction
reading chapters takes time
recognize that clicker game is nothing more than a pencil paper thing
recognized diff between iterations of game - even if something fails, kids are forgiving
recognizing active learning is better
referencing game during instruction
reinforcing in-game praying frequency during in-class instruction
researcher became part of lesson
researcher/game influence on teacher's approach to teaching - more let the kids be hands on
role of activities to add fun to content
running out of time
seeing things in game that they know will have meaning to students
several versions of test
shifting from emphasizing recall
sitting at desk w/ paper & pencil --> walking tours --> take photographs --> game is even another level because they don't know they're learning
start lessons with preview - ask how do you know that?
student with agency in game creates different meanings
surprised to see game influence carry through unit
Talk more about Rev War than usual because of game
taught how to use GPS map so kids could play game better
teacher modifying walking tour to ensure game success
teachers sharing class-gaming experiences with other teachers - who adjusted
Teachers wondering if taking the test away would be better for the kids
teachers work together
teaching changed in Y2 because understood game better
tech engages all kids
thinking of adding a physical map (kids adding buildings) to unit
this GBL experience changed negative perceptions of gaming to a more positive one
time pressure forces active learning out
tried to balance teams/partners - strong reader + weaker student --> maybe weaker student might be good at games
try to tie unit to culture/history of school
use of clickers
use of Ginsey game for review
using peer scaffolding for book activities
view book activities as a good way to reach different learners
view game as having broad appeal for all types of learners
view GBL experience as "not just a lesson", fun.
view use of iPad as a contemporary approach
viewed agent debrief as summarizing activity
viewed agent interview as priming activity
viewing game as generating excitement for whole unit
viewing guest speaker as less impactful as game
viewing potential impact of game on different classes
want kids to have a love of learning
want kids to have deeper appreciation for school and history
want kids to retain info
want kids to share what they've learned
want more game
Wanting to figure out a way to make game PART of the curriculum, not just something extra
was concerned about logistics but it worked out...hope it continues to work
weak readers might be good prob solvers
wondering if flipping the game as enrichment/unit as core model would be good --> game as core and unit wrap around as enrichment?
wondering if game could replace written test for assessment
worried about being able to handle the game, but got comfortable
worried about how tech is always changing

Level 2 Codes:

game is add-on
game is catalyst
direct instruction
student-centered instruction
culture of school
opinion of GBL
teacher as designer
decision making

Final Codes:

Shift of game's role
Shift of teacher's role
Decision making evolution
GBL opinion evolution
Cultural influences

Curriculum Vitae

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Research and Teaching Interests

Game-based learning, augmented reality, geospatial tools for teaching and learning, mobile learning, constructivist theory, social studies education

Education

PH.D. | 2018 | LEHIGH UNIVERSITY

- Teaching, Learning, and Technology
- Dissertation: Investigating the Effect of a Curriculum-embedded Augmented Reality Constructivist-inspired Game within an Early Elementary Social Studies Curriculum and its Influence on Student Experiences, Learning Outcomes, and Teacher Instructional Practices

M.S. | 1997 | UNIVERSITY OF NEW HAMPSHIRE

- Kinesiology with emphasis of study: Sports Psychology and Sports Media
- Thesis: So What if the Sports Media Trivializes Women? An Exploratory Study Examining the Effect of the Sports Media on Young Female Athletes and their Self-Perceptions.

B.A. | 1991 | UNIVERSITY OF NEW HAMPSHIRE

- Major: English
- Minor: History

Publications

Bressler, D. M., **Oltman, J. L.**, & Vallera, F. L. (2018). Inside, Outside, and Off-Site: Social Constructivism in Mobile Games. In J. Keengwe (Ed.), *Handbook of Research on Mobile Technology, Constructivism, and Meaningful Learning*. Hershey, PA: IGI Global. http://doi.org/10.4018/978-1-5225-3949-0.ch001

Scholarly Presentation

Hammond, T.C., **Oltman, J.L.**, & Alexander, R. C. (2018, March). Enhancing Early Elementary Civics Education Through Augmented Reality Games. In *Proceedings of Society for Information Technology & Teacher Education International Conference 2018* (SITE). Washington, D.C.

Oltman, J.L., & Hammond, T.C. (2017, April). *"I Almost Wanted to Touch Them!" Curriculum-Embedded Game-Based Learning for Young Elementary History Education*. Presented as part of a Symposium at the annual meeting of the American Educational Research Association (AERA), San Antonio, TX.

Oltman, J.L. (2017). *ARIS Games for Elementary Social Studies*. Presented at the 2017 Pennsylvania Educational Technology Expo and Conference (PETE&C), Hershey, PA.

Hammond, T. & **Oltman, J.L.** (2016). The sleeping giant awakens? Two cases in geospatial tools re-shaping curricular content in elementary social studies. In G. Chamblee & L. Langub (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2016* (pp. 1637-1640). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Oltman, J.L., & Hammond, T.C. (2016, June). *Moravian History Mystery: Elementary Game-Based Learning About Colonial America*. Presented as a Research Paper at the annual conference of the International Society for Technology in Education (ISTE), Denver, CO.

Hammond, T.C., & **Oltman, J.L.** (2016, March). The Sleeping Giant Awakens? Two Cases in Geospatial Tools Re-Shaping Curricular Content in Elementary Social Studies. Presented as a Paper at the conference of the Society for Information Technology and Teacher Education (SITE), Savannah, GA.

Oltman, J.L. (2016, August). *Three Games for Elementary Social Studies*. Presented at the 2016 ARIS Global Summit, Madison, WI.

Oltman, J.L. (2016, August). *Get the Data!*. Presented at the 2016 ARIS Global Summit, Madison, WI.

Oltman, J.L. & Hammond, T.C. (2015). Exploring the use of a location-based iPad augmented reality game for elementary history education. In D. Rutledge & D. Slykhuis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* 2015 (pp. 818-821). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

Oltman, J.L., & Hammond, T. (2015). *Moravian History Mystery: A Mobile, Digital, Augmented Reality, Game-Based Learning Experience for Young Elementary Students*. In K. Caldwell, S. Seyler, A. Ochsner, & C. Steinkuehler (Eds.), Games+Learning+Society Conference (GLS) (Vol. 1, pp. 410–416). Retrieved from http://press.etc.cmu.edu/files/GLS11-Proceedings-2015-web.pdf

Bressler, D., & **Oltman, J.L.** (2015, August). *Putting the "AR" in Farm: Baaaad or Good?* Presented at the 2015 ARIS Global Summit, Madison, WI.

Hammond, T.C., **Oltman, J.L.**, & Mendez Martinez, D. (2015, June). *Inside, Outside, Between: Recipes for Augmented Reality in Social Studies*. Presented as a Poster at the conference of the International Society for Technology in Education, Philadelphia, PA.

Hammond, T.C., & **Oltman, J.L.** (2015, October). *Community Needs, Community Resources: A 21st Century Approach to the Elementary Social Studies Classic*. Presentation at the Teaching, Learning, and Technology Summit, Bethlehem, PA.

Oltman, J.L. & Hammond, T.C. (2015, October). *Moravian history mystery: A mobile, digital, augmented reality, geospatial, game-based learning experience for elementary students.* Poster presented at the Lehigh University College of Education Distinguished Lecture Series, Bethlehem, PA.

Working Papers

Oltman, J.L., & Hammond, T.C. (In revision). *"I almost wanted to touch it": Flow and learning in game-based history education with augmented reality for early elementary students*. Journal of Educational Computing Research.

Hammond, T.C., & **Oltman, J.L.** (In preparation). *Enhancing early elementary civics education through augmented reality games.* Social Studies and the Young Learner.

Professional Experience

COLLEGE OF EDUCATION | LEHIGH UNIVERSITY | 2017-PRESENT
Adjunct Professor
Courses Taught:
- Summer 2018: ES/TLT 468: Teaching & Learning with Geospatial Tools (Graduate Level)
- Summer 2017: ES/TLT 468: Teaching & Learning with Geospatial Tools (Graduate Level)

DEPARTMENT OF ATHLETICS | LEHIGH UNIVERSITY | 1997-PRESENT
- Assistant Athletic Director for Technology: 2009-Present
- Director of Camps & Emerging Technologies: 2004-2009
- Director of Camps: 2002-2004
- Head Women's Soccer Coach: 1997-2002

DEPARTMENT OF ATHLETICS | THE OHIO STATE UNIVERSITY | 1995-1997
- Assistant Women's Soccer Coach

DEPARTMENT OF ATHLETICS | UNIVERSITY OF NEW HAMPSHIRE | 1990-1995
- Assistant Women's Soccer Coach