ABSTRACT

Norris Darell Parker. UTILIZING SCRIBBLENAUTS TO INCREASE READING COMPREHENSION AND IMPROVE LITERACY SKILLS OF THIRD GRADE STUDENTS (Under the direction of Dr. Robert M. Reardon) Department of Educational Leadership, March, 2015.

The LEA's problem of practice upon which this research was focused on improving academic achievement in the areas of reading comprehension, fluency and other literacy skills. In particular, the LEA is very concerned about third grade reading scores in the light of North Carolina legislation that implements a reading proficiency test to be taken by all third grade students. The focus of this research was to use "Scribblenauts Unlimited," a commercial-off-the-shelf video game to bolster the reading skills of third grade students in an elementary school located in a rural school district in eastern North Carolina. The research design of this action research study utilized pre - and post- assessment to measure the effectiveness of students' involvement with "Scribblenauts Unlimited." The intervention time-line consisted of sixteen weeks of intervention during which two sections of students alternated the roles of intervention and control groups at the eight-week mark. The intervention was implemented for one hour per week during student computer laboratory times. The one-hour per week exposure was divided into two thirty-minute sessions, one on each of two days each week. The quantitative data consisted of participant's scores on the Reading 3D assessment. The qualitative data was gathered by means of video observations of selected small groups of students and, snapshot insights into individual participants' learning experiences by means of experience sampling methodology. During each intervention time, a video camera was set up in the computer laboratory and focused on a small group of four or five participants. One or two of the members of the group on which the video camera was focused were invited to "think aloud" through excerpts of the edited videos. The aim was to capture the participants' learning experience in

their own words at what they seem to be key points of their learning trajectory. At the end of each eight-week intervention session, a survey designed to measure the extent to which participants experienced flow was administered to the participants in the intervention.

UTILIZING SCRIBBLENAUTS TO INCREASE READING COMPREHENSION AND IMPROVE LITERACY SKILLS OF THIRD GRADE STUDENTS

A Dissertation

Presented to

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In Partial Fulfillment

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Doctor of Education in Educational Leadership

by

Norris Darell Parker

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DEDICATION

My Lord and Savior, Jesus Christ. As I reflect on this experience, I choose to glorify the One whose love, grace, and mercy have guided and sustained me through tremendous challenges and rewarding experiences. My life's journey has not been a linear one. I pray that You will continue to walk with me no matter the path You have chosen. All things are possible through You, who gives me strength. This dream fulfilled is proof of that.

Next, I would like to thank my family for their love and patience. My mother, Carolyn Richardson, has been a perpetual source of unconditional love. Simply put, I would not be here or anywhere without you. Thank you for your words of encouragement, your supportive silence, and your unwavering support. My father, John L. Parker, taught me a long list of life lessons. You taught me the importance of honoring my blessings, but your greatest gift to me was being a shining example of loving all children, including me. My wife of nineteen years, Regina, is my best friend and partner in life. You have walked with me through both good and bad times and yet, Christ has enabled us to laugh, share, serve, and persevere together. You are beautiful. I love you. And I'm not going anywhere. My daughters, Maya and Morgan, are my inspiration. My love for you creates perpetual joy in my heart. As I often say while waking you in the morning, "You are beautiful, wonderful, precious, special and super-duper smart!"

I thank my church family at Believer's Fellowship Center for their love, patience, and continual prayer covering. Pastors Bea, Rick, and Diane Carson have been instrumental in my spiritual growth. I thank the Rose family for their love and support. My aunts and uncles have been mothers and fathers to me. My cousins, namely, Terence Pope, have been my brothers and sisters. I thank the Rodgers family for loving me like one of their own, especially Deford and Ruth Rodgers who showed me love, kindness, humor, and a wonderful example of sustaining a

marriage based in Jesus Christ. I thank the Parker family for their love and kindness. I hope that our relationship will continue to grow.

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CHAPTER ONE: INTRODUCTION

The popularity of videogames has grown to the point where they have become ubiquitous in our society (McGonigal, 2011a). According to a report titled *Kids and Gaming 2011* (NPD Group, 2011), ninety-one percent of children (approximately 64 million) ages two to seventeen are gaming in the United States. This is an increase of nine points when compared to 2009. According to the NPD Group (2011), while 68% of these two to seventeen year olds play most of their videogames on consoles (51% of United States households), smartphones, and tablet devices (Android and iOS) have seen the largest growth, rising from 8% to 38% from 2009 to 2011. If educators could embrace this growing phenomenon, videogames could potentially create a new tipping point in education (Gee, 2007b).

According to Gee (2007b), videogames can provide an authentic learning environment that promotes growth in knowledge and problem solving. Games take time to master through trial and error. Gee and Schaffer (2010) propose that when videogames meet instructional goals, they can promote higher order thinking skills, and provide opportunities to foster creativity and encourage productive social interaction. Videogames can also provide constant assessment – focused on improving a player's performance – that players enjoy, and that allows players to embrace failure as a natural part of learning as they strive to master assigned skills (Dondi & Moretti, 2007).

Videogames as Opportunities for Educational Programming

Since its inception, television has been an ever-expanding medium in American households used primarily for entertainment (Wainwright, 2006). Wainwright (2006) asserts that with the advent of shows such as *Sesame Street* in the late 1960's, television became a tool to teach children in an academic sense. Wainwright points out that leading up to the era of

children's educational programs, broadcasters and child advocacy groups fought over the content of programming because the ubiquitous nature of television offered the potential for mass access to educational programs. The networks wanted programming that generated the most revenue so they advocated for entertainment programming dominated by cartoons and variety shows. Entertainment programming became the norm despite the continued pleas of the Federal Communication Commission (FCC, Levi, 2009). The efforts of those interested in ensuring the delivery of educationally oriented television eventually culminated in the passage of the *Children's Television Act of 1990* (CTA, United States Congress, 1989). The journey from purely entertaining television to more educational television programming has been punctuated by many studies that examined the cognitive makeup of preadolescent children in order to understand how to capture their attention, and to construct and implement measures of the effectiveness of educational television programming (Wainwright, 2006).

Sesame Street marked the beginning of a new era in which educational research began contributing to program design for television audiences (vom Orde, 2012). In a manner similar to television, videogames have the potential to become powerful teaching tools and again similarly to television, educational researchers can play an important part in the continued development of videogames.

Problem of Practice

A problem of practice dissertation is designed to address a situation within the researcher's context of professional practice that the researcher or in this case, the Local Education Agency (LEA), feels it needs improvement or correction. After a review of the literature, the researcher attempts to explore the causes and to create solutions for the situation through a project or study that produces a measurable result (Mikeska, Anderson, & Schwarz,

2009). The LEA's problem of practice upon which this research was focused was to improve academic achievement in the areas of reading comprehension, fluency and other literacy skills. In particular, the superintendent and assistant superintendent were very concerned about the LEA's third grade reading scores in the light of North Carolina legislation that implements a reading proficiency test to be taken by all third grade students. This practice began during the 2013-2014 school year (see Appendix A).

As part of the *Read to Achieve* legislation (N.C.G.S. §115C-83.1A) passed by the General Assembly in 2012, students can show their reading proficiency by achieving a proficient score on the end of grade test or by qualifying for a good cause exemption. These exemptions could include limited English proficiency students, exceptional students whose individual education plans (IEP) require the use of alternate assessments, students who achieve a proficient score on thirty-six short assessments that cover several objectives or students who pass a *Read to Achieve* alternative assessment if the State Board of Education grants the LEA permission to use that assessment.

The *Read to Achieve* passages are based on the Spache readability word list (My Byline Media, 2014). This word list is considered to be a grade level list of everyday words (see Appendix B). While the law does allow for good cause exceptions, the intent is that students who do not pass the end of grade proficiency test on the first two attempts or a Read to Achieve alternative assessment will attend a reading camp to help improve their reading skills. If the student's parents do not agree to send their child to reading camp, the student may repeat third grade the next school year.

This particular LEA has utilized the Reading 3D program (Amplify, 2014a) to measure third grade student reading proficiency since the 2010-2011 school year. Reading 3D

assessments consist of Dynamic Indicators of Basic Early Literacy Skills (DIBELS) and Text Reading and Comprehension (TRC). DIBELS measures phonemic awareness, text accuracy and fluency, reading comprehension, alphabetic values, and vocabulary. TRC measures reading comprehension through the use of leveled booklets to determine each student's instructional reading level. The leveled booklets are specific to each student's reading level, as indicated by the use of letter levels. Students are challenged to read leveled benchmark books, and complete exercises that assess oral and written comprehension, recalling, and retelling skills. Depending on their performance, Reading 3D suggests higher or lower level books to home in on the student's true reading proficiency level (Amplify, 2014a).

DIBELS Oral Reading Fluency and Accuracy or DORF measures reading fluency (Amplify, 2014c). In this instrument, fluency is measured by a child's ability to correctly read a number of words over a short period of time. Children's performance is measured by having them speed-read through a passage aloud for one minute. Omitted and substituted words, as well as hesitations that last three seconds or more are scored as errors. However, students have the chance to redeem these errors if they self-correct words within three seconds. The oral reading fluency score is represented by the number of correct words per minute from the passage. The oral reading accuracy score is represented by the percentage of words read correctly in the one-minute passage reading (Amplify, 2014d).

In Reading 3D, students are assessed during three, three-week periods that are called Beginning-of-Year (BOY), Middle-of-Year (MOY), and End-of-Year (EOY). For the 2014-2015 school year, the BOY window starts on September 2, 2014 and ends on September 22, 2014. The MOY window starts on January 7, 2015 and ends on January 30, 2015. The 2014-2015 EOY window begins on April 27, 2015 and ends of May 15, 2015 (Amplify, 2014a).

Students are divided into four grade levels of proficiency (well above proficient, above reading proficient, below proficient, and well below proficient) depending on their performance in various areas (Amplify, 2014a).

According to the intent of the current legislation, students who attend the summer reading camp will be retested at the end of that session. If they achieve a proficient score after the reading camp, students will be eligible to be promoted to fourth grade. Students who do not pass the test at the end of reading camp will either be enrolled in a third or fourth grade accelerated class designed to produce two years of reading growth in one year, or a third/fourth grade transition class (North Carolina Legislature, 2014). In either scenario, the LEA is then responsible for providing these students with ninety uninterrupted minutes of daily reading instruction. The proficiency test is administered to these students for a fourth time in late October to attain a mid-year promotion and to have the third-grade retention label removed from their record. The students who fail the late October administration remain classified as fourth-grade students with a reading retention label, and continue to receive the same ninety uninterrupted minutes of reading instruction for the remainder of the school year. Clearly, the involvement of any number of students in such a process would place an enormous additional burden on the LEA that is the focus of this research.

In the light of the focus LEA's third-grade reading scores shown in Table 1, the superintendent is very concerned about the potential cost of implementing such a remedial program for a large number of students. It is clear that in the absence of an effective intervention, the four-year trend gives substance to the superintendent's concerns.

Third grade reading proficiency scores for the 2012-2013 school year were the first scores to be based on the Common Core State Standards (Common Core, 2014). The test results

Table 1

Target School's End of Grade Reading Scores from 2010-2013

EOG Scores	2010-2011	2011-2012	2012-2013
School Proficiency	40.4%	54.2%	25.5%
District Proficiency	64.0%	59.2%	36.5%
State Proficiency	67.6%	68.8%	45.2%

for 2012-2013 were not released until November 7, 2013 and the approximate raw score range to determine proficiency is listed in Table 2. This score range requires students to correctly answer at least thirty-six out of forty-four questions in order to achieve a level three, which is considered to be proficient. This is a huge departure from past scoring practices. In fact, sixty-one percent of the state's students would have been proficient if the 2011-2012 standard was applied to 2012-2013, whereas only 45.2% of students scored proficient (North Carolina Department of Instruction, 2012).

The proficiency scores for 2013-2014 represent this school's second effort under the Common Core State Standards. Unlike the previous year, the school-level scores were released within twenty-four hours of the test administration. They reflect the career and college readiness standards. Hence, the level 4 and 5 scores from 2013-2014 can only be compared to the level 3, 4 and 5 scores from 2012-2013 for a true year-to-year comparison of proficiency. The grading cut-off scores were modified for the current (2013-2014) school year. Each level of proficiency received a new descriptor, and a level five was added to the proficiency scale. However, level 3 is still the minimum level for a student to be considered proficient and levels 4 and 5 are designated to have met the state standards for college and career readiness (North Carolina Department of Instruction, 2014a). Under the 2013-2014 new cut scores, it is slightly easier to score a level 3 since this level can be achieved by correctly answering thirty-three questions as opposed to thirty-six required under the previous set of cut scores. This study will be conducted in the context of the revised levels that are listed in Table 3. This focus LEA's problem of practice is the challenge of improving student literacy skills and reading scores.

Table 2

2012-2013 End of Grade Testing Cut Scores for Grade 3 Reading

	Level 1 Well Below Proficient	Level 2 Below Proficient	Level 3 Proficient	Level 4 Well Above Proficient	Total Number of Items
Cut Score	0-24	25-35	36-40	41-44	44

Table 3

2013-2014 End of Grade Testing Cut Scores for Grade 3 Reading

	Level 1 Limited Proficiency	Level 2 Partial Proficiency	Level 3 Sufficient Proficiency	Level 4 Solid Proficiency	Level 5 Superior Proficiency	Total Number of Items
Cut Score	0-25	26-33	33-35	36-41	42-44	44

The Potential Role of Videogames

In proposing a role for videogames in addressing the focus LEA's problem of practice, it is very important to describe how videogames promote learning through their ability to captivate and motivate players. It is equally important to distinguish between learning and performance (Buckley & Anderson, 2006). These issues will be fully explored in detail in the review of literature, and will include the underpinning of several key concepts. However, the following brief overview serves to ground the current discussion. Van Eck (2009) describes learning as the process of participant growth in acquiring new information, while performance is the measurable use of this information. He also posits that intrinsic motivation and situated cognition are important pieces of the integration of commercial off the shelf games (COTS) into classroom instruction.

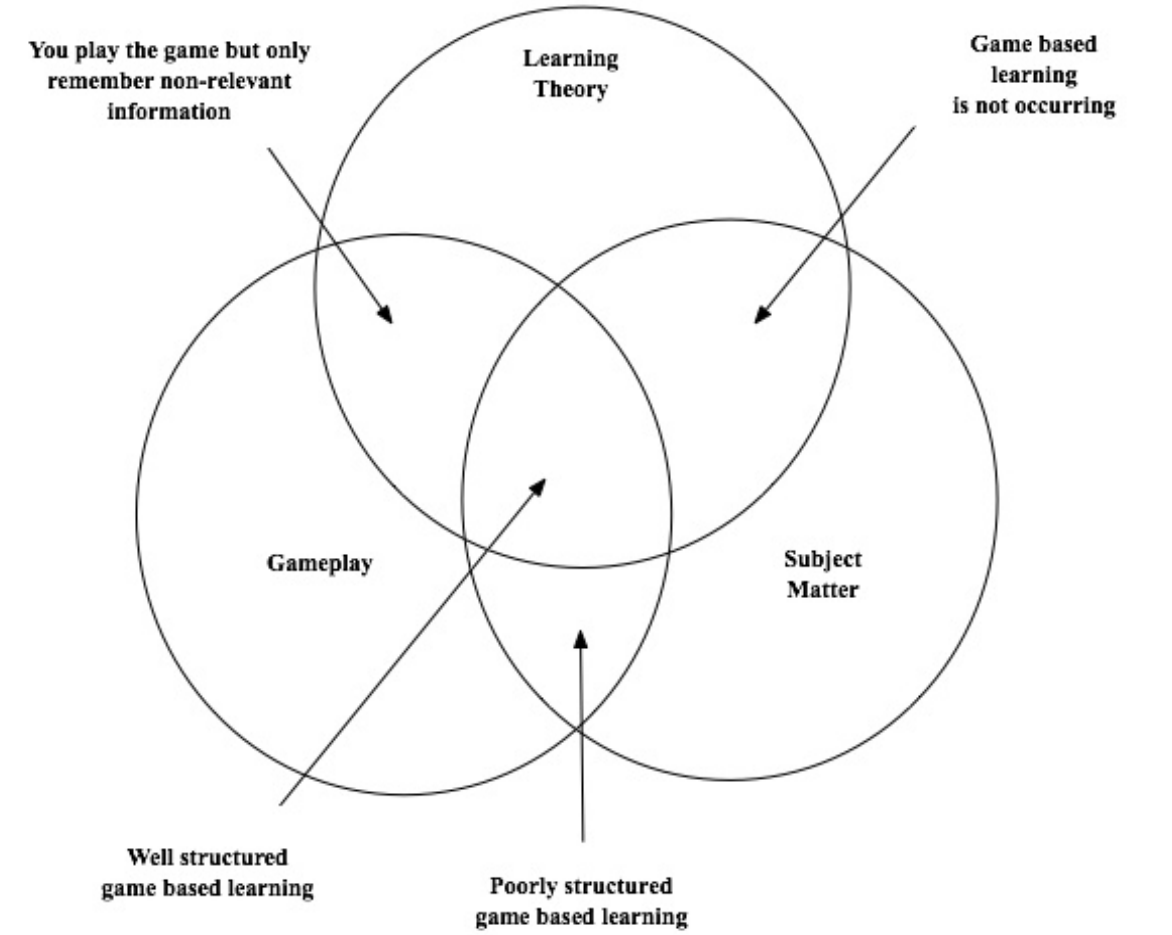
Gee (2003) describes how videogames enhance the learning process through invoking the concept of the semiotic domain, or the phenomenon of how events and points of information take on different meanings in different settings. In contrast to a traditional environment where student learning is closely tied to teaching content based upon distinct and separate subject such mathematics and reading, situated cognition invokes learning in a gaming environment that allows the learner's exposure to subject matter to be closely tied to the ever changing environment of the game. This changing environment is not tethered to particular subject areas, so students derive content from the tasks that each chosen game puts forth. Therefore, learning becomes active and continually relevant to the task at hand (Swanson, 2013). It is important to note that every student will not like every game used for educational interventions. However, the main goal is to reach a wider group of learners by increasing accessibility to areas such as

comprehension and higher order thinking skills that traditional teaching has difficulty addressing (Schwartz, 2014a).

Using COTS games is currently the most cost-effective way to implement digital game-based learning in terms of money and time (Van Eck, 2009). COTS games are usually more appealing to participants because experienced game designers have created the games specifically in order to engage the target participants, and, additionally, they have a commercial appeal that makes them very engaging. Because of their appeal, COTS games have the potential to create powerful teaching moments by helping get students excited about a topic while teachers plan accompanying activities that connect these experiences to planned learning objectives (Schwartz, 2014b).

Learning Theory and Classroom Implementation

When implementing COTS into classroom instruction, it is important to examine how learning theory, gameplay, and subject matter interrelate to potentially enhance learning. COTS games were not originally designed or intended to teach educational curriculum, so they cannot stand on their own as teaching tools (Van Eck, 2009). As described in Figure 1, when gameplay is combined with learning theory but omits subject matter, enjoyable experiences happen, but participants play the game, and only remember non-relevant information. When gameplay focuses on relevant subject matter (for example, as incorporated in content standards) but is absent of learning theory, participants are exposed to educational material without effective learning taking place. Finally, when subject matter (content standards) is combined with learning theory without gameplay, game based learning is not occurring. It is the overlap of all three components that the potential for a synergistic relationship develops and well-structured game based learning occurs (Van Eck, 2009).



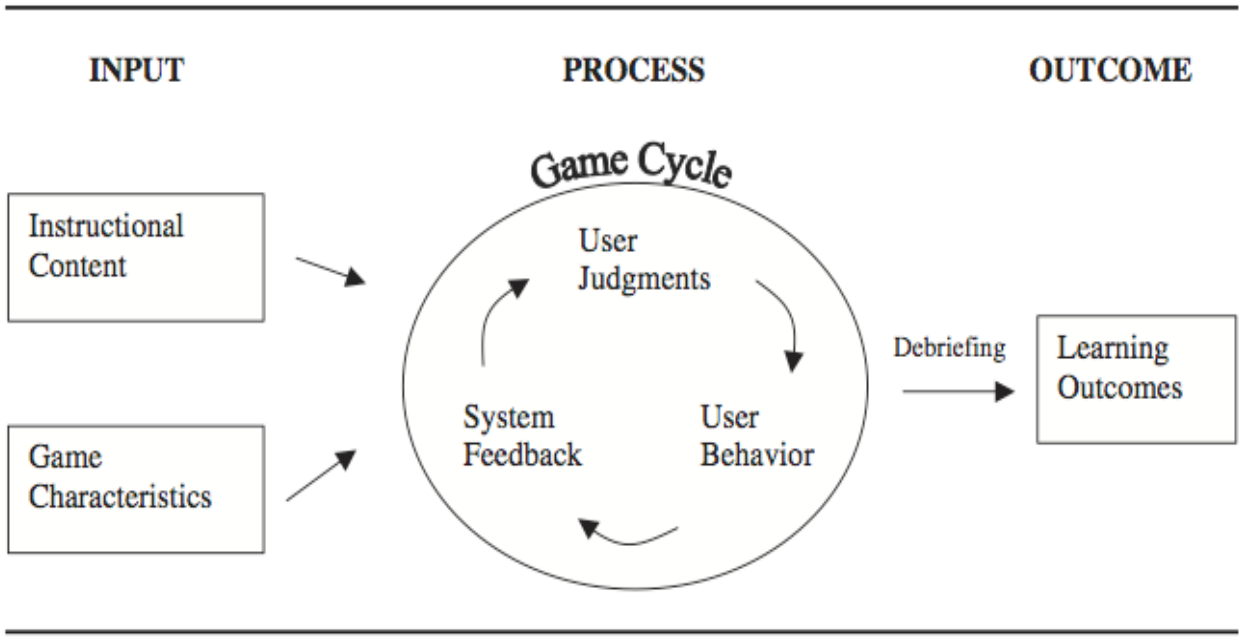
Adapted from the class presentation “Integrating COTS Games into Your Classroom," by C. Kasemodel, 2009.

Figure 1. Interaction between gameplay, learning theory, and subject matter.

As described in Figure 2, Garris, Ahlers, and Driskell (2002) highlight the importance of considering the interaction among participant's judgments, behavior, and system feedback when examining how gameplay affects learning outcomes. This model conceptualizes how to produce improved learning outcomes through the use of its key component, the game cycle. The game cycle proposes a model for how players are drawn to participate in a game repeatedly. Garris et al. (2002) observe that participants in their study continue playing videogames without stopping until prompted to do so by the person monitoring the study. This learning environment envisages a process whereby a continual cycle of user judgments and behaviors are influenced and encouraged by the game's feedback or interface. The significance of the game cycle is that, if this model is valid, the user is continually learning instructional content because of the game's engaging characteristics.

How Videogames Can Increase Student Engagement

Student engagement is an important part of successful pedagogy. One of the most challenging tasks faced by educators is the motivation of children and youth (Crenshaw, 2008). Maslow (1943) theorizes that deficiencies in motivation must be addressed before learning and growth can occur. Factors such as motivation and emotional state play a key role in facilitating student engagement and memory (Deci & Ryan, 2000; Fredricks, Blumenfeld & Paris, 2004). Videogames have the potential to motivate because participants have control over the action, and they experience what Gee (2003) calls just-in-time learning. Just-in-time learning describes how users are provided with a minimum of information, and practice only the requisite skills to complete the task at hand instead of being potentially overwhelmed with a broad range of information pertaining to a variety of different junctures of the game. Gee (2003) hypothesizes that participants are intrinsically motivated to grow their skill set in the game environment until



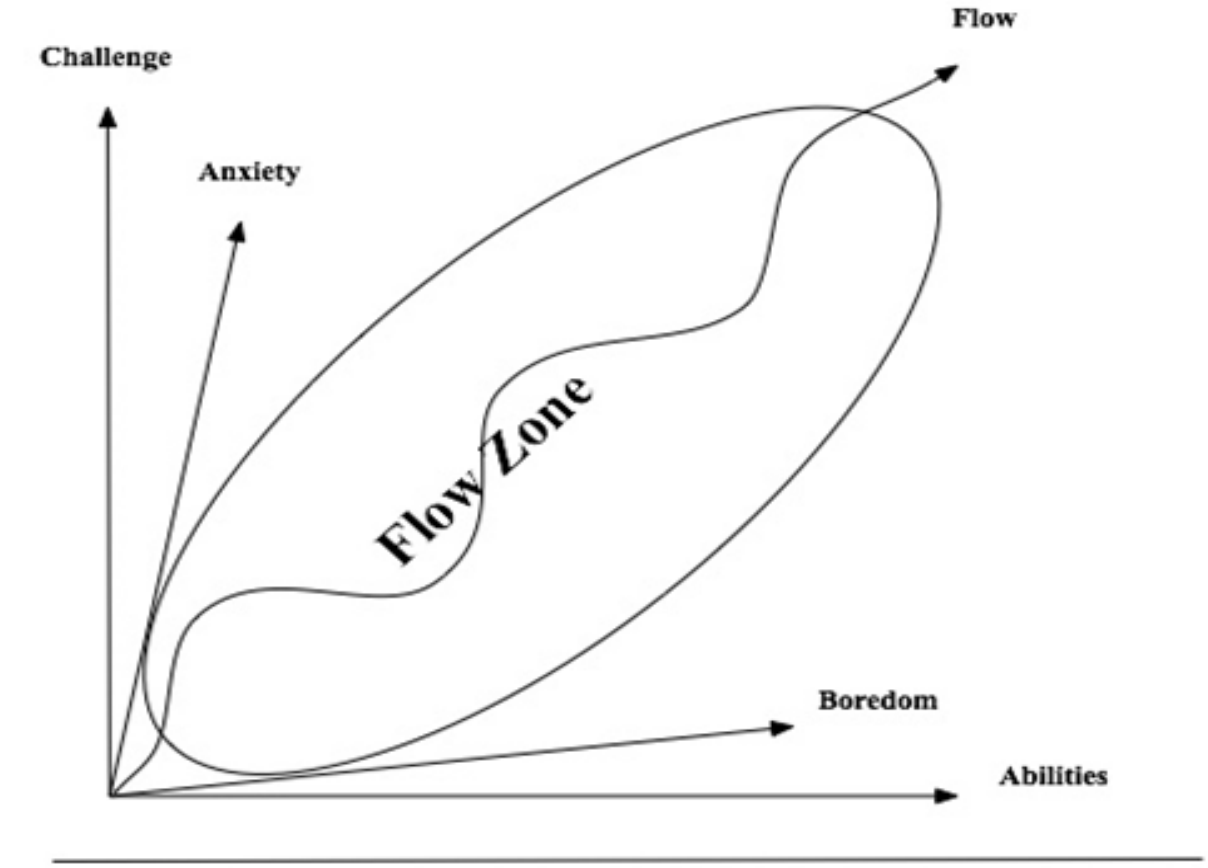
Adapted from "Games, motivation, and learning: A research and practice model," by R. Garris, R. Ahlers, & J. E. Driskell, 2002. Simulation & Gaming, 33(4), 445.

Figure 2. The effect of user judgments and gameplay on learning outcomes.

they attain mastery because they are in a state of play and are continually reassessing their efforts. This speaks to the point made by Van Eck (2009) that, in order to affect player outcomes, content must be integrated with gameplay to optimize intrinsic motivation. This type of motivation occurs during effective gameplay and corresponds to what is described by Csikszentmihalyi (1975, 1997) as flow.

Motivation and Flow

Csikszentmihalyi's (1975, 1997) theory of flow describes a state of participant contentment and concentration in an activity where challenge and skill are in balance and the sense of elapsed time dissipates because the person is deeply involved in that activity. Csikszentmihalyi described this state of mind as a flow state. When an individual is in the flow state in a digital game context, the level of challenge presented by the activity and the user's level of skill must be in balance in order for the user to reach this deep level of involvement. When the challenge is not commensurate with the user's skill level, he or she becomes frustrated with an activity and tends to quit. If the challenge is too high for the user's skill level, he or she will be anxious, and optimal involvement will not follow. Conversely, if the challenge is too low for the user's skill level, he or she will become bored. The flow state, however, potentially emerges when the level of involvement of participants is such that they experience high levels of self-esteem, focus and accomplishment, as well as lower stress and anxiety because they are continually expanding their skill set (Csikszentmihalyi, 1997; Gee, 2007a). The opportunity for users in a learning activity to achieve a state of flow is a facet of an effective instructional environment. It is represented graphically by described by Chen (2007), as shown in Figure 3.



Adapted from "Flow in games (and everything else)," by J. Chen, 2007, *Communications of the ACM, 50*(4), 32.

Figure 3. Flow zone theory.

The concept of flow is both explicitly and implicitly referenced in a body of research in the context of gameplay. Bowman (1982) applied Csikszentmihalyi's (1997) flow theory to the environment of videogames. After studying participants who played videogames, particularly Pac-Man, he argued that videogames contribute to the state of flow when they provide clear goals and feedback as well as progressively balancing the participant's skills and challenges. Mitchell and Savill-Smith (2004) asserted that videogames provide appropriate challenges so that each player's skill level remains congruent to the level of difficulty, thereby maintaining an appropriate learning environment. Sweetser and Wyeth's (2005) research used an eight-point scale called GameFlow to describe participant enjoyment of learning while playing videogames. Fong-Ling, Rong-Chang, and Sheng-Chin (2009) built upon the research of Sweester and Wyeth (2005) and proclaimed that the creation of a flow effect was the main objective that learning videogames try to achieve.

Method of Intervention

The focus of this action research approach was to use videogames to bolster the reading skills of third grade students in an elementary school located in a rural school district in eastern North Carolina. The first goal was to increase each participant's reading comprehension by one letter level as measured by Reading 3D's text reading and comprehension measure or TRC (Amplify, 2014h). As stated earlier, the letter levels of the leveled booklets correspond to each student's TRC reading level. The second goal was to increase each participant's reading fluency by twenty-five words from beginning-of-year (BOY) to middle-of-year (MOY). While the expectation is that the use of COTS videogames would appeal to a large majority of the children involved with this approach, it is important to acknowledge that "as with all other approaches to learning, instructional technology only works for some kids, with some topics, and under some

conditions – but that is true of all pedagogy. There is nothing that works every purpose, for every learner, and all the time" (Mann, 2001, p. 241).

Action Research Approach

Action research is the methodological approach for this study (Anderson, Herr, & Nihlen, 2007; Herr & Anderson, 2005). Herr and Anderson (2005) described action research as a process where a researcher studies his or her practice in order to increase his or her competency level as it relates to, for example, program improvement and instructional delivery. Herr and Anderson (2005) stated that action research is designed to address an action or series of actions that need improvement or correction. They go on to say that action research should be done by or with those who are a part of the research setting. Stringer (2014) breaks down action research into various phases. One of his first phases is setting the stage for the study. When doing this, Stringer (2014) suggests that says that action researchers should take on the role of catalyst and to assist stakeholders in defining their problems. Finding a way to get stakeholders to be an active part of framing the research activity is an integral part of setting the stage for meaningful action research. In the case of this study, the researcher collaborated with the educational leaders within the LEA to initiate this problem of practice. The assistant superintendent of the LEA drafted a letter to this effect and it can be found in Appendix A.

Stringer's (2014) next phase is to gather the data. He points out several ways to do this but declares that the primary source of data in action research comes from interviewing participants. Interviews allow participants to reflect on their experiences in relation to the study's focus. It is important for researchers to frame their questions in a neutral manner in order to minimize bias. In the case of this study, the questions were adapted from the work of Fang, Zhang and Chan (2013). These questions were designed to access the concept of flow

(Csikszentmihalyi's, 1975, 1997) during the participant's gameplay experience. Stringer (2014) also suggests that records, reports, as well as visual media may be used to collect pertinent data. Students in this proposed problem of practice will be interviewed with the use of a video camera as a way to gain a better understanding of the participant's impressions about their gameplay experience.

According to Stringer (2014), analyzing and reflecting on the gathered data is the next step in action research. Here, the researcher's main goal is to interpret the information in a manner that both enlightens otherwise overlooked impressions about the examined topic and frames them in terms that stakeholders can readily understand. Stinger (2014) mentions applying the verbatim principle to do this. This method asks researchers to frame the information using terms and themes that stakeholders can readily recognize and utilize on a regular basis. Analyzing the data can be framed by interpretative questions, organization review, concept mapping, and problem analysis. Regardless of the chosen path, Stringer (2014) declares that collaboration must be a major part of any data reporting. This study endeavors to improve student performance by utilizing game-based interventions. While this pedagogy may be unfamiliar to some, the data, especially Reading 3D information, will be expressed in terms that the LEA has been using since they adopted this assessment tool.

After the data has been analyzed, Stinger (2014) encourages researchers to collaborate with pertinent stakeholders to create a plan of action to sustainable improvements for the problem of practice. Each goal of the proposed action plan should enumerate objectives, tasks to achieve that objective, person's responsible, applicable facilities, a timeline, and necessary resources. The culmination of these factors should result in outcome statements that describe what the plan aspires to achieve. Ultimately, Stringer (2014) stresses the importance of

collaborating stakeholders throughout the process in order maximizes the effectiveness of the team's efforts by thinking about sustainability from the outset of the research activities.

Research Plan

Two class-sized groups of third grade participants – each group containing participants of roughly comparable overall achievement with an age range of seven to nine years – were invited to participate in the intervention. Both groups of participants received the same exposure to the videogame intervention, but not in overlapping cycles. Both groups received the usual reading instruction program until beginning-of-year (BOY) assessment was completed. Hence, Group A utilized the videogame approach as a supplement to their usual reading instruction program for eight-weeks after beginning-of-year (BOY) assessment was completed, while Group B engaged in just the usual reading instruction program. At the end of the first eight weeks, all participants in the study were progress monitored to enable the comparison of reading achievement changes between the two groups. Progress monitoring allows educators to determine Reading 3D levels between the beginning-of-year (BOY), middle-of-year (MOY), and end-of-year (EOY) assessment periods. The situation was then reversed, so that Group B used the videogame supplement. Again, at the end of eight weeks, middle-of-year (MOY) reading achievement testing enabled comparisons to be drawn. A covariate approach was adopted to take into account participants' initial achievement, race, and gender. As stated above, the overall aim was to increase each participant's reading comprehension by one letter level as measured by Reading 3D (Amplify, 2014a), but this design assisted in interpreting the degree to which the engagement with the videogame contributed to the enhancement of the reading achievement of the participants. Hence, this intervention ran for two eight-week periods.

Evidence of Effectiveness

Reading 3D data was used to examine the gains in reading achievement comparatively between the two groups, and overall. Flow (Csikszentmihalyi, 1975, 1997) was also measured in this study by analyzing the participant's responses to questions based on eight elements of flow as proposed by Csikszentmihalyi (1993) and utilized by Fang, Zhang and Chan (2013). The eight elements are (a) a challenging activity that requires skill, (b) the merging of action and awareness, (c) clear goals and feedback, (d) concentration on the task at hand, (e) the paradox of control, (f) the loss of self-consciousness, (g) the transformation of time, and (h) autotelic experience. Fang et al. (2013) created an instrument to measure these flow elements based on the work of Moore and Benbasat (1991).

Fang et al. (2013) employed a multi-step process to create, develop, and test the validity of this instrument. Their first stage involved the examination of studies that used scales and other instruments to measure flow. In order to align these findings with the eight elements of flow, the language of the items was modified to reflect the context of videogame play and items that were not applicable to the context of videogame play were removed. The first stage resulted in the creation of thirty-eight items that described the elements of flow in computer game play. Fang et al. (2013) then used experienced videogame players to determine the effectiveness of the thirty-eight items and sort them into categories. The videogame players were majoring in computer games and had played videogames for at least fifteen years at the time of the study.

Fang et al. (2013) created several iterations of the instrument before finalizing their study. During this process, the number of items in the instrument was reduced from thirty-eight to twenty-three. Items such as transformation of time element and the autotelic experience were removed and, the clear goals and clear feedback elements were merged. The twenty-three-item

instrument that will be used during this study is displayed in Appendix I. Each item of the instrument was analyzed by Lexile level. Rounded to the nearest 10L, a Lexile level is a measure based on the analysis of the semantic and syntactic elements of a text (Lexile, 2014). This measure provides a targeted reading experience by matching the reader with a leveled text that challenges their ability but is easy enough to prevent their frustration. The levels were calculated by uploading each via text file to the Lexile generator on their website (Lexile, 2014).

How the Research will be Conducted

The intervention was be implemented for one hour per each week (Girard, Ecalle, & Magnan, 2013) for two eight-week cycles during student computer lab times. The one-hour per week exposure was divided into thirty-minute sessions two days each week. The study began in the last week of September of 2014, and ended in early January of 2015. The start date allowed enough time for our teachers to clarify beginning-of-year classroom procedures and to administer assessments to gauge each child's reading level. The end date allowed time to refine student instruction after the study was concluded in preparation for end-of-grade testing.

The LEA level technology staff and school level administrators facilitated the intervention's preparation process. After purchasing hard copies or downloads of the game, the staff members installed the program onto each desktop computer in a computer laboratory. After the game was installed (twenty-five computers), each computer had an icon located on the desktop that participants double-clicked with the mouse's left button to open the program. After they used their login for their assigned computer, participants used headphones instead of speakers when they are using Scribblenauts.

Choosing the Videogame for the Intervention

Choosing games that align with relevant curriculum goals can be a challenging process

because there must be a blend of pedagogy and engagement (Van Eck, 2006; see Figure 1). In other words, games must actually teach skills and knowledge, and still be exciting and engaging to players. If either relevance to the curriculum or student engagement is absent, as shown in Figure 1, then the learning environment will not be optimal. It is hypothesized that an appropriately configured commercial off-the-shelf game is the most effective way to balance these elements (Van Eck 2006).

When choosing an appropriate and engaging commercial off-the-shelf game, it is important to ensure that the objective of the game is clear to the teacher and participant, and educators should consider whether the participant's role in gameplay is passive or active (Griffiths, 2002). To wit, some gameplay only allows participants to watch as events transpire onscreen instead of being able to manipulate a character by way of some input device. A game's rules and structure can also be based on luck as opposed to skill. The former can lead to a more passive experience, while the latter requires that participants practice and refine their skills over time. Videogames that involve skill encourage players to learn from past experiences, and this can an important part of learning (Griffiths, 2002).

The intervention used the PC-based game "Scribblenauts Unlimited." "Scribblenauts Unlimited," a COTS game, requires players to correctly spell words and use them in the correct context in order to progress through the game. When coupled with the challenge of moving the main character, Maxwell, through the story, the game attempts to join the skills of spelling and the contextual use of vocabulary with an engaging interface. The participant then places these objects in specific areas to complete each gaming level.

The concepts of game difficulty, duration and competition are also relevant to the choice of Scribblenauts. Based on the principles of flow theory (Csikszentmihalyi, 1975, 1997), the

game's level of difficulty should present a balance between anxiety and boredom (Chen, 2007). In terms of this action research project, an easy game can become boring while a demanding game may hinder some player's engagement. Even better, some games adjust their difficulty level as the player progresses through the use of tutorials (Gee, 2007a). The gameplay structure of Scribblenauts begins with an interactive tutorial that teaches the participant how to move the main character as well as to place and manipulate each object after the participant has created it. The level of difficulty gradually ramps up as the participant completes each game level or world. Scribblenauts lists fifteen worlds to complete. Further details will be provided in Chapter 3.

Research Questions

This action research was framed by three research questions. The first two questions focused on the relationship between videogames and academic performance. The last question explored the videogame's effect on the state of flow.

1. What will be the effect of "Scribblenauts Unlimited" on student reading comprehension and fluency?
2. Will the prescribed use of "Scribblenauts Unlimited" improve and expand student vocabulary?
3. What will be the impact of "Scribblenauts Unlimited" on student flow state?

Definition of Terms

Commercial off-the-shelf games – Games created for commercial consumption as opposed to games created solely for educational or school-based purposes (Van Eck, 2009).

Reading 3D – A software-based reading assessment program for kindergarten through fifth grade students that utilizes a running record to display student achievement. The running record is comprised of three two-week assessments periods. They are called beginning, middle

and end of year assessments. The first assessment (beginning of year or BOY) is starts within the first two weeks of the school year. The second assessment (middle of year or MOY) begins in early January and the last assessment (end of year or EOY) is administered in early May (Amplify, 2014a).

Dynamic Indicators of Basic Early Literacy Skills or DIBELS – A series of short procedures designed to measure the literacy and reading skills of kindergarten to sixth grade students. DIBELS measures phonemic awareness, text accuracy and fluency, reading comprehension, alphabetic values and vocabulary (Dynamic Measurement Group, 2014).

Common Core and North Carolina Essential Standards - A set of educational objectives designed to increase higher thinking skills of kindergarten through twelfth grade students and to prepare them for college and career readiness (Common Core and North Carolina Essential Standards, 2014).

Text Reading and Comprehension or TRC – A measure of reading comprehension that uses leveled booklets to determine each player's instructional reading level (Amplify, 2014h).

Situated cognition – A theory that posits that effective learning is strongly tied to relevant domain and meaningful context (Van Eck, 2009).

Intrinsic motivation – A condition where learning occurs without the need of external reward or fear of punishment (Van Eck, 2009).

Flow - When an individual's level of challenge presented by an activity is in balance with the individual's level of skill. This balance creates a deep level of involvement called flow.

Motivation - The process of providing a reason for someone to act or to fulfill certain needs (Maslow, 1943).

Engagement - In the sense of student learning, engagement refers to the level of effort, attention, and participation that a student gives during the instructional process (Rigby, 2001).

Digital native - A person who was born into the digital age. They have only lived in one technological context. Their bond with technology is readily apparent in their continual adoption of new devices and their elaborate use of social media (Prensky, 2001).

Digital immigrant - Someone who was born into the analog age and has experienced the transition into the digital age in his or her adult years. They have lived in two technological contexts. Their bond is conditional on their connection or comfort with the analog age (Prensky, 2001).

First person shooter - Played from the perspective of the videogame's protagonist, these videogames allow players to move throughout a virtual world in order to defeat enemies and overcome obstacles (Jannsen, 2014a).

Massively multiply player online game or MMO - This type of videogames allows many users to enjoy interactive play simultaneously in the same online virtual world (Jannsen, 2014b).
Transformative play - Videogame play where the player becomes engrossed in the story as its protagonists and uses his or her experience to get a better understanding of the content (Gee, 2011).

Active learning - Learning through multiple sensory inputs in a collaborative setting with a focus on problem solving instead of rote learning (Gee, 2007b).

Title 1 - Funding sources targeted toward schools with the highest percentages of low-income families in order to help them meet state academic standards (North Carolina Department of Instruction, 2014b).

Likert scale - A methodology designed to access the cognitive attitudes of people by asking for a responses to a series of statements about a topic. The responses are measured on a multi point scale that assumes that the strength of the attitudes is linear (Likert, 1932).

Dopamine - A neurotransmitter controls the reward and pleasure centers of the brain. It helps us not only to see rewards, but also to take action to move toward them (Gee, 2011).

Didactic teaching - A teaching approach where the presentation of information to students occurs without open-ended questions. Student feedback is only intended to confirm or deny their understanding of the teacher's presentation (Ritchie & Gutmann, 2014).

Autotelic experience - Experiences that are so driven through internal motivation and enjoyment that the person's activity and goal become synonymous. In other words, the person's goal is to participate in the activity simply because it is so rewarding. Exterior forces such as rewards for participation or penalties for non-participation become irrelevant (Csikszentmihalyi, 1997).

CHAPTER TWO: LITERATURE REVIEW

As stated previously, millions of young people play video games (McGonigal, 2011b). According to McGonigal (2011b), a game designer and author,

> We spend 3 billion hours a week as a planet playing videogames. Currently there are more than half a billion people worldwide playing computer and videogames at least an hour a day. 183 million play in the U.S. alone. The younger you are, the more likely you are to be a gamer -- 99% of boys under 18 and 94% of girls under 18 report playing videogames regularly. The average young person racks up 10,000 hours of gaming by the age of 21 -- or 24 hours less than they spend in a classroom for all of middle and high school if they have perfect attendance. It's a remarkable amount of time we're investing in games. 5 million gamers in the U.S., in fact, are spending more than 40 hours a week playing games -- the equivalent of a full time job. (p. 1)

This proliferation is a sign that we are living in the digital age. In March of 2012, President Obama challenged educators to design instructional software as captivating as the best video games (Squire, 2013b). The Federation of American Scientists (2006) has also called for more federal funding in this area because they believe that videogames can revolutionize education. In the same vein of these proposals, the ultimate goal of this problem of practice is to empower teachers to utilize videogames to enrich their instruction in order to improve the reading proficiency and fluency of this school's third grade students.

Teaching a Generation of Digital Natives

Prensky (2001) coined the terms digital immigrant and digital native to describe how society has adapted to our world of growing technology. The term digital immigrant describes those who grew up in an analog age but have grown accustomed in differing degrees to the

digital age. However, like most immigrants, digital immigrants carry baggage in the form of bias and preconceived notions about the digital world. Unfortunately, their baggage can adversely affect their ability to accept the changes that are happening around them. Conversely, the term digital native describes those who were born and have remained immersed in the digital age for their entire lives. These people have played a wide variety of videogames throughout their childhood. Many of these videogames provide the opportunity for them to communicate and solve problems in a creative and collaborative environment (Schaffer, 2006).

Prensky (2001) declares that digital natives have a different expectation of the world in terms of communication, responsiveness, and connectivity. Technology deeply affects and defines their most heartfelt relationships. For example, many digital natives create and sustain relationships purely through social media, and these bonds are very real and important to them. Since digital natives respond to a variety of media, they benefit from a diversification of instructional delivery regardless of content to better meet their needs (Prensky, 2001). Educators could enhance their instructional environment by making an effort to reach these students through the use of interactive experiences that motivate and actively engage them in the learning process. Squire (2006) declares that videogames have the potential to be utilized as designed experiences where students can learn through the accomplishment of goals and objectives in virtual worlds. This perspective of videogames encourages educators to look at the actions and decisions that occur during gameplay as a measure of learning because some videogames present multiple paths to completion and skill attainment. Squire (2006) sees a dichotomy between the structures of traditional educational videogames that can be described as repetitive drills in an electronic format and the autonomy, problem solving, and collaborative solutions that some

COTS videogames encourage their participants to pursue. Gee (2007a) posits that videogames have been producing and refining inspiring learning environments for many years.

Unfortunately, many educators fail to use this technology in innovative ways (Gee, 2011). This narrow paradigm toward the use of technology is leading to a cultural divide where many of our students, especially boys and racial minorities, are not being reached. As McGonigal (2001b) mentioned earlier, 99% of boys under 18 report playing videogames regularly. Reichert (2010) posits that many teachers at the elementary level facilitate classrooms that expect boys to sit in circles or quietly read for hours at a time but this expectation is not reasonable for many of our boys. Many boys are physically active and today's overstressed teachers and educators tend to under-serve these students because their natural tendencies disrupt the efforts of many teachers to keep up with the pacing guides or just adequately cover the curriculum (Ritchie, 2011).

Games can hold a very powerful a place in education. However, it remains to be seen whether educators will continue to uphold traditional instructional practices or whether educators will effectively use videogames alongside literature, writing, and other subjects to improve both active and critical thinking (Goodman, 2013). Kapp (2012) asserts that facets of gaming like (a) the encouragement of exploration, (b) permission to fail and (c) positive social engagement effectively present content through engaging story lines and relevant challenges. According to Kapp, these facets give learners a sense of autonomy and accomplishment that lead to increased motivation and authentic learning.

Gee (2011) addresses the concept of authentic learning through concept of active learning. Gee suggests that students who engage in rote learning tend to experience curriculum in a passive manner. When students begin to learn through multiple sensory inputs and that

stimulus occurs in a social setting with a focus toward practical application and problem solving, then active learning is taking place. When playing a videogame, a participant usually plays an introductory level or tutorial and uses this new information, sometimes in a collaborative setting, to enhance his or her game play. Many videogames also give hints, clues or boundaries to keep a player on task. Gee (2007b) suggests that these types of environments are where students could learn from experience and then applies such learning in different contexts in such a way that these skills are a key factor in building skills like reading comprehension.

How Videogames Can Improve Student Learning

Squire (2006) suggests that many digital natives first learn about history or other content related areas through videogames as opposed to television or movies. This initial exposure to student learning has the potential to identify new ways to look at how videogames can affect student learning. Gee (2011) points out how videogames only gives the participant enough information needed to overcome the present situation. For example, signs and directions posted in a level or in-game tutorials provide relevant information to allow the players to progress through a learning environment. Next, videogames promote critical thinking and problem solving because they encourage the exploration of each environment and requires players to continually rethink his or her strategies to achieve success. Memory retention is also enhanced because videogames are very appealing, visually stimulating, and emotionally engaging to players (Rondon, Sassi, & de Andrade, 2013). Memory retention appears to be bolstered by fact that the playing of videogames has been associated with the release of the neurotransmitter dopamine (Rondon et al., 2013). Dopamine is associated with the feeling of accomplish and satisfaction that players get when they accomplish something significant. This feeling of accomplishment is referred to by Gee as the epic win sensation.

As mentioned before, videogames may be very effective in motivating some students, in part because they present continuous feedback and well-defined goals and outcomes (Garris, Ahlers, & Driskell, 2002). Gee (2011) claims that students who play videogames are motivated to get to the next level or conquer their opponent whether that opponent is another player or the computer. The social aspect of sharing strategies and resources that aid in their progression helps to reinforce what they have learned. This process invoked by Gee to account for this motivation is transformative play. Transformative play, Gee suggests, transcends the mere act of player participation and creates an experience where the player becomes a protagonist in the story and uses his or her knowledge and skills to build a deeper understanding of the content. Barab, Gresalfi, and Arici (2009) suggest that this immersion in the virtual game world creates a sense of consequentiality where participants consider the implications of their actions before and making decisions or offering their input. This process helps to build problem solving skills.

Rubin (2014) conducts background research for developers of first person shooter videogames such as "Medal of Honor" to ensure their historical accuracy. Videogames like these can provide alternative ways for players to virtually experience significant moments in history. Some researchers argue that first person shooters increase violent and aggressive behavior (Anderson & Warburton, 2012). Other researchers (Ferguson, 2013) have found no correlation between playing violent video games and augmented bullying or other violent behaviors in clinically depressed children or children who have displayed attention deficit symptoms. Ferguson studied three hundred and seventy seven children who averaged thirteen years of age from diverse ethnic backgrounds who exhibited the aforementioned symptoms. Ferguson's findings link these detrimental behaviors with environmental aggressiveness and stress rather than experiencing video game violence. Intriguingly, Ferguson actually found that

violent videogames had a slight cathartic effect on these children in a few instances. Goldstein (2001) suggests that studies that attempt to correlate playing videogames with violent behaviors are meaningless exercises. He suggests that there is no way to show that videogames actually cause aggression even if there is a correlation between aggressive behavior and the recorded time spent playing videogames that some may deem violent. Goldstein says that the violence in videogames is simulated and a far cry from the experiencing of actual violent acts because the gamer can stop playing at his or her leisure. Squire (2006) argues that there is a difference between the presence and the advocating of videogame violence. He suggests that many videogames that have violent elements offer players to choice to use violence as a means to complete objectives within the game or use choose other means to achieve success.

Creating an Effective Classroom Environment with Videogames

Videogames can be a tool to redefine the role of teachers. In an ideal situation, teachers could become designers of learning who craft meaningful player experiences. Tack (2013) asserts that our classrooms should move away from the factory model of education where everyone is expected to learn at the same pace and at the same level of complexity. Game-based learning has the potential to enhance instruction by allowing each learner to master objectives and topics at his or her own pace.

The use of videogames in the classroom has the potential to encourage students to take risks and explore new challenges because many of today's popular COTS games are difficult to master. McGonigal (2011b) suggests that when students fail to reach an objective, they may be motivated to reattempt the task, and they may be very determined to reach his or her goals. Wagner (2008) declares that students want experiences that do not insult their intelligence. However, students are discouraged from intellectual exploration and risk taking if they deem the

cost of failure is too high. Although he did not provide any empirical support, Wagner (2012) suggests that many of our best students are very skilled at extracting the answers to multiple choice and other forms of assessment from his or her teachers in order to get a good grade with minimal knowledge application. According to Wagner, this approach does not prepare our students for the future workforce or institutions of higher learning. Educators should endeavor to give students the freedom to fail without derision.

Choosing a COTS Videogame to Accomplish Educational Goals

Van Eck (2009) suggests that integrating game-based learning in the classroom is an undertaking that can seem overwhelming. First, he suggests that teachers should consider the matter of curriculum. To wit, they should focus on what is being learned and how their pedagogy aligns with necessary and meaningful learning experiences. Next, Van Eck asks teachers to reflect on the matter of instruction. In this step, they should examine their role in classroom activities and decide which activities should be teacher-guided and which ones should be self-directed by their students. Van Eck believes it is important to note that simply referencing or bringing games into the classroom does not make an effective lesson. Teachers should endeavor to effectively plan and practice how videogames will be used in their classrooms. While Van Eck believes it is true that many current games designed specifically for education may not be engaging to many students, many COTS videogames have the potential to be very appealing and could be applied to existing curriculum areas. If chosen carefully, Van Eck believes COTS videogames have the potential to provide a variety of ways to enhance classroom instruction.

Role-playing games, a genre of COTS games, present various social structures where players can take on various roles and attributes that all have interrelated implications (Kuo,

2012). "World of Warcraft", a role-playing and massively multiplayer online game (MMO), challenges gamers to work together and communicate in real time to complete quests and challenges (Schwartz, 2013). These videogames have the ability to bring people together to accomplish a common goal or to match wits in a strategic battle. Gamers can build relationships through the use of MMOs to work toward relevant accomplishments such as ranks, badges or virtual currency (Yee, 2006). Roscoria (2010) reports that teachers have successfully applied this videogame to the eighth-grade Common Core Standards language arts curriculum.

Videogames can also provide opportunities for student to explore computer programming or coding (Strobel, 2007). Programming languages control graphics and activity parameters into a virtual digital setting. Scratch is a website that encourages elementary-aged children to create interactive projects and stories which are the building blocks of gaming (Scratch, 2014). Other programs such as the iPad-based game "Daisy the Dinosaur" allows younger students to drag and drop commands in order to animate a cartoon character (Whiteboard Blog, 2013).

How Videogames Can Promote Social Understanding and Cultural Awareness

Granic, Lobel and Engels (2014) suggest that children who play videogames receive cognitive, motivational, emotional, and social benefits. The cognitive benefits are exhibited by increased focus and attention. The participants experience motivational benefits because the objectives of most videogames are segmented so the skills required to achieve the game's objectives are taught incrementally so they are not bombarded with nonessential information. Emotional benefits arise from an increase in positive mood states during gameplay. Finally, participants benefit from the increased use of pro-social skills because many videogames encourage collaboration by allowing them to work towards completing missions and objectives in a virtual digital environment. Granic et al. (2014) note that the responsibility of educators

goes far beyond the teaching of curriclum and content. They assert that it is equally important to tie these facts to a context that enhances their students' social understanding and that there are many COTS videogames that confront relevant social and cultural issues.

"Bioshock Infinite" is a good example of a game in this genre that debuted in April of 2013. The story is set in the early twentieth century in the fictional city of Columbia. Issues of race and class are introduced when the player is made aware that the city is mostly Caucasian and most people of color are ostracized or enslaved (VanOrd, 2013). The participant, playing as the story's protagonist, is set in the year 1912 in the fictional and floating city of Columbia where the landscape continually reminds the participant of the powerful antagonist's racist ideals. For example, there is a church that honors John Wilkes Booth, Abraham Lincoln's assassin. The participant is then charged with the task of standing against these ideals and defeating the forces of the city's leader.

Videogames, like the MTV (Music Television) produced Darfur is Dying, tackle issues such as terrorism, poverty, and other sensitive themes in a way many students can relate to. The game is a narrative based simulation where the participant plays as a displaced Darfurian who must negotiate with Janjaweed military forces, who are backed by the Sudanese government, to ensure the survival of his or her refugee camp (Darfur, 2014).

The Urban Ministries of Durham, North Carolina designed a game called "Spent" (McKinney, 2011). The organization is a faith-based provider of food and shelter for North Carolinians in need. "Spent" puts the player in the shoes of a homeless person who has lost his or her life savings, and invites the player to choose one of three low-paying jobs to see how quickly money is spent and allow players to empathize with their plight.

Students at the IT-University in Copenhagen created "3D World Farmer" in 2005. This

game puts the player in charge of an African farm. The players must keep their family, crops, and livestock alive while dealing with conflict and a lack of resources. The game designers want players to realize the hazardous nature of life in Africa.

"Sweatshop" depicts the player as a factory manager who must make important choices that affect crying or injured children who are making high-end sneakers. Players must decide whether to provide a safe working environment or focus on the company's bottom line in an effort to enlighten them about the conditions in which a lot of the world's clothing is manufactured (Staff, 2012).

"Karma Tycoon" begins with a grant from a Chase Bank and asks players to move their karma meters to full by committing acts of kindness such as helping people through homeless shelters and youth centers. The game seeks to teach players the importance of social and fiscal responsibility (Staff, 2012).

Gee (2007b) suggests that the implementation of game-based instruction can be a very powerful tool for teaching our students about their world and to increase his or her literacy skills. He suggests that the integration of images, visual symbols and the written word create multimodal texts. These texts, Gee suggests, not only teach skills such as decoding or first sound fluency but also encourages participants to focus on accomplishing tasks and interacting with others in order to increase their proficiency levels. Gee values such learning because, in the digital age, he proposes that print literacy is not sufficient to succeed. However, effective implementation will necessitate educators who are willing to dialogue with their students to gauge their interests and research these areas as they create their lessons. Active learning is a key concept in this effort because it describes a learning environment where educators are moving away from rote learning into applying curriculum into relevant experiences. Gee

compares conventional learning to giving students a textbook that lists all of the rules and facts about a sport but are never allowing them to play a game. By contrast, videogames have the potential for increasing learning by providing more engaging learning experiences. Several strategies for facilitating such enhanced learning will be discussed in the next section.

Strategies for Videogame Classroom Implementation

Beyond the effort to improve instructional practices, there are larger issues that accompany the practical integration of videogames into classrooms. Even if educators are soundly convinced about the merits of game-based learning, they must figure out how they can consistently and effectively integrate this concept in their teaching (Heick, 2013). First, it is important to know that an effective implementation of game-based learning does not call for the transforming of classrooms into arcades. However, it does require teachers and educators to gradually introduce new practices and evaluate their effectiveness based on student reactions and their performance on various levels of assessment (Hawkins, 2012). For example, teachers could start with a videogame center that can used in a rotational basis or they could introduce a concept that could be enhanced by a game.

In order to aid in this transition, there are some practical approaches and strategies for implementing game based learning in our classrooms but they require our educators to take some risks (Heick, 2013). The first step is to allow students to play videogames during school hours using a variety of sources and platforms (Inal & Cagiltay, 2007). For many teachers, this can be one of larger obstacles in implementing game-based instruction. However, teachers must be willing to decrease their amount of didactic teaching in order to support this practice (Ritchie & Gutmann, 2014).

If a teacher is prepared to try game-based enhancement of learning, there are several

gaming platforms to choose from. Van Eck (2009) suggests that students can play games on mobile devices such as tablets (Apple iPad and Microsoft Surface), Android smartphones, iPhones, or other mobile devices such as Nintendo DS, Sony PSP or Vita. Consoles like the Sony PlayStation Three and Four as well as Microsoft Xbox 360 and Xbox One could also be utilized. PC gaming is also a possibility that takes advantage of the hardware in many school computer labs, including the one in this study. These options can provide teachers with the opportunity to become designers of instruction when deciding which games to play and how each game will be used to enhance instruction. This process provides a wonderful opportunity to dialogue with players about which games appeal to them and why. Their thoughts can be expressed, recorded, and responded to in many ways that ensure that the instruction will be motivating and relevant to each player (Heick, 2013).

Balsamo (2011) theorizes that classroom videogame implementation could create an educational environment where students could be "prosumers" (p. 134). Prosumers are a hybrid of producers and consumers. In the context of instructional delivery, students should be encouraged to produce and create material as a result of their interactions with games. Marquis (2012) points out that many games have level editors where students can create maps, tracks, and other types of playing environments. Trybus (2012) suggests that entire units could be planned to allow students to research markets and demographics, explore the demand for certain videogame genres such as first person shooters and role playing games, evaluate existing trends in gaming such as the use of violence and motion capture, present an idea for a game, collaborate on a game's creation (real or imagined) and plan its marketing. Trybus (2012) also declares that students could benefit from a plethora of writing and multimedia assignments that encourage them to compare, contrast, analyze, and evaluate their gaming experiences. Marquis (2012)

suggests that the creation of such products after planning, collaboration, and problem solving until their completion would be an ideal and rewarding educational experience for students and these higher level skills are a huge part of building our students' literacy and 21st century skills.

Changing how our classrooms operate can also mean that we can reexamine how we acknowledge, motivate, and reward students (Heick, 2012b). For example, teachers can use digital badges and experience points to provide a source of motivation for digital natives. These methods go far beyond the gold stars and stickers that some teachers might add to graded materials that satisfied the chosen objective. Like the virtual relationships in Facebook, Instagram, and other social networking sites, these trophies provide a real and meaningful sense of accomplishment for digital natives. As opposed to only using an A through F letter grades, badges can provide a more specific portrayal of what students have accomplished, and serve as a visual reminder of their accomplishment as they are collected over time. This collection of badges could serve as a significant motivating factor as a student progresses through his or her scholastic career (Heick, 2012b).

How Videogames Can Motivate Our Students

The power of play in education is only beginning to be understood by psychologists and sociologists (Rigby, 2011). Gaining a deeper understanding of this phenomenon could help reshape and improve the way we educate students in powerful ways. Rigby asserts that people who enjoy videogames often describe their attraction through their perceptions of accomplishment and escapism. While many gamers may enjoy retreating into other realities, the real motivations for human play are multifaceted and videogames fulfill several everyday psychological needs in a number of positive ways. Rigby is a founding partner in Immersyve, a research company designed to discover what makes video games so appealing. After collecting

several years' worth of behavioral data and conducting numerous in-house studies from companies like Sony, Activision, and Warner Bros. Interactive, Rigby feels Immersyve has identified several motivations behind the public's affinity for videogames. Rigby explains that we all have basic psychological needs that constantly operate in all facets of life, and games effectively target these needs (Rigby, 2011).

According to Rigby and his colleagues, the Player Experience of Needs Satisfaction narrows down the enjoyment of gaming to three basic categories (Przybylski, Rigby, & Ryan, 2010). The first is a need for competence or the desire to seek mastery over a skill or situation. Players need to feel successful in their efforts to grow in their achievements and video games can help players feel more accomplished. Every time a child attains a higher level or defeats a boss, games are fulfilling their desire to feel competent because they are overcoming obstacles and other challenges. Rigby identifies autonomy as the second need. In this context, it is the desire to have a certain amount of control over the game's environment. Autonomy permeates nearly every part of the gaming culture. This is why open world games like "Grand Theft Auto" are so popular (Lynch, 2013). Children want to be in control of their destiny, and this point is obvious in our classrooms where a student's curiosity may lead a teacher away from his or her scripted curriculum (Rigby, 2011). Curiosity is integral to effective learning and teachers must be able to harness this energy in a positive manner. The third need is relatedness. Students need to feel like they matter to others and videogames can fulfill this need for relatedness as participants play online or in another collaborative environment. Experiences that allow students to feel more competent, more autonomous, and more related increase their self-esteem and improve their academic outcomes because the instruction is more relevant to their interests (Rigby, 2011).

Self-Determination Theory (Deci & Ryan, 2000; Ryan, Huta, & Deci, 2008) proposes the

same three innate psychological needs postulated by Rigby and his colleagues (2010). Collectively, these studies describe how the needs of autonomy (i.e., experiencing psychological freedom), competence (i.e., feeling successful), and relatedness (i.e., feeling valued) must be fulfilled for a person to feel happy and content. Ryan and Deci (2000) theorized that students who exhibit intrinsic motivation are more likely to be authentically engaged in their lessons.

Rigby and Przybylski (2009) declare that self-determination theory provides a tool to illustrate how videogames bring about this type of motivation in students. Rigby and Przybylski (2009) explain that when participants play in order to accomplish a goal or to discover new and difference ways to complete level, missions, or objectives, they can be characterized as learner heroes. As learner heroes discover new areas (autonomy), master new challenges (competence), and collaborate with others (relatedness), Rigby and Przybylski (2009) suggest that participants become more self-determined and this could be a promising framework for improving instructional delivery.

Limitations of Digital Game-Based Learning

Numerous limitations surround the use of digital game-based learning in schools. These could be conceptually grouped as (a) limitations inherent in the instructional use of the digital game-based environment at this point of time, and (b) limitations associated with cost and accessibility.

Inherent Limitations

When choosing an appropriate videogame for classroom use, educators may be limited in their choice by the mature and often violent content of some videogames, which could give rise to parental concerns. There is a considerable amount of videogame research that focuses on negative effects such as aggression, addiction, and depression (Anderson, 2010; Ferguson, 2013;

Lemola et al., 2011). Two survey studies (Gentile, 2009; van Rooij, Schoenmakers, Vermulst, van den Eijnden, & van de Mheen, 2011) have found signs of pathological symptoms of addiction in about three percent of Dutch youth and about 8% of American children who play videogames.

Anderson and Warburton's (2012) meta-analysis of several game-related studies argue that videogames are addictive as well as promoting violent behavior. Anderson and Warburton begin by highlighting the saturation of videogames among young people. They referred to a study by Lenhart, Kahne, Middaugh, Macgill, Evans, and Vitak (2008) that suggests that around ninety nine per cent of American boys play videogames, along with ninety four per cent of girls. Next, Lenhart et al. (2008) declare that a large number of the videogames that they children play contain violence. To support this point, they highlight that "Call of Duty: Modern Warfare 2" and "Grand Theft Auto IV", which cost approximately sixty dollars, grossed five hundred and fifty million dollars and five hundred million dollars, respectively, in the first five days of their releases on the retail market. Next, Anderson and Warburton discuss the issue of the frequency of videogame play sessions. They cite the claims of Bailey, West and Anderson (2010) that many American youth play videogames for more than twenty hours per week and many boys commonly play forty hours or more per week.

Anderson and Warburton (2012) attempt to link the popularity of videogames to violent behavior by claiming that the general aggression model (Anderson, Bushman, & DeWall, 2011) provides a way to understand how exposure to violent media can increase a person's likelihood of being aggressive. The general aggression model examines how a person's psychological process may lead to acts of aggression. Anderson et al. (2011) suggest that cues and triggers interact with each person's individual propensity to aggress to create violent behaviors. They

also suggest that higher levels of arousal, varying personal beliefs, and different attitudes may increase this likelihood. Anderson and Warburton (2012) argue that playing violent videogames for extended periods of time help to exacerbate these factors by continually exposing them to violent acts. Anderson and Warburton address the variableness of individual propensity to aggress by citing a study by Bandura, Ross and Ross (1963) that claims that children tend to imitate violent behaviors even if the behaviors are new to them and there is no source of external motivation.

Gentile, Lynch, Linder and Walsh (2004) declared that students who played violent videogames were more hostile, reported getting into arguments with teachers more frequently, were more likely to be involved in physical fights, and performed more poorly in school. Gentile et al. conducted a study of six hundred and seven students in eight and ninth grades. One of the study's goals was to determine if there was a correlation between violent video game exposure and student difficulties in their school environment. These difficulties were identified as arguments with teachers, poor school grades, and physical fights.

Gentile et al. (2004) suggested that this videogame playtime had the potential to adversely affect grades by displacing time spent in other educational and social activities. In this study, teachers from four schools were trained to administer surveys to his or her eight and ninth grade students. The data was collected for a period of one month. The surveys used a Likert scale and were designed to gather data about the students' school performance as well as information about their videogame playing habits. A seven point Likert scale where 1 was "rarely" and 7 was "often" was used to ask the participants were asked to rate how frequently they played videogames compared to other activities such as watching television, listening to music or reading for pleasure. Gentile et al. (2004) found that more time was spent watching

televisions (mean score of 25.3) and listening to music (mean score of 20.7) than playing video games (mean score of 9.0) but less time was spent reading for pleasure (mean score of 3.4). Only six percent of the participants reported that they never play video games, and fifty-nine percent reported to playing videogames at least once a week.

A seven-point Likert scale where 1 was "little or no violence" and 7 was "extremely violent" was utilized to determine the participant's preferred about the games they were playing in terms of violent content. Gentile at al. (2004) found the participants preferred a moderate amount of violence in their videogames with a mean score of 5.4. The boys preferred higher levels of violence with a mean score of 6.7 as compared to the girls who scored at 3.8. Only one percent of boys and sixteen percent of girls in the study preferred to have no violence in video games.

Gentile et al. (2004) also asked participants to self-report in other areas. They were asked how many hours per week were devoted to videogame play. An average of nine hours per week was reported, thirteen fours per week for the boys and five hours per week for the girls. Participants were also asked to use a four-point Likert scale where 1 was "almost daily" to 4 was "less than monthly" to self-report about arguments with teachers with the past year. Twenty-three percent of the group reported getting into arguments with their teachers on an "almost weekly" or almost daily" basis. Boys (28%) were more likely to argue with his or her teachers at this rate than girls (17%).

Participants were asked to self-report about their average school grades, ranging from A+ through F and physical fights within the past year in the form of a yes or no response. The girls reported to having higher grades than boys. The means score for the girls were B+ and the boy's

mean score was B. The boys reported getting into more physical fights, at 47%, than the girls at 19%.

Gentile et al. (2004) reported some correlation among these factors. They found that participant hostility levels were significantly correlated with their media habits. More specifically, participants who consumed more electronic media, and preferred to play videogames with violent content tend to exhibit more hostile behaviors and have lower school grades.

Skoric, Teo, and Neo (2009) conducted a study on three hundred and thirty-three children ages eight to twelve years to assess the relationship between academic performance and videogame habits with a focus toward identify addictive behaviors. Fifty-four percent of the participants were boys and girls made up the remaining 46%. Academic performance was measured in the subject areas of English, math, and science. Skoric et al. (2009) used questions to collect behavioral data, while academic grades were obtained directly from school officials.

Skoric et al. (2009) utilized a four-point Likert scale where 1 was "a little time" and 4 was "a lot of time" to access the amount of time that participants spent playing videogames on weekdays and weekends. The mean scores for weekdays were 2.53 and weekends were 2.54. The study found a significant positive correlation between English test scores and playing videogames on weekdays, but there was little correlation with math and science test scores. The reported time devoted to playing videogames on weekends did not show a significant correlation with test scores in English, math, or science.

Skoric et al. (2009) utilized a six-point Likert scale where 1 was "strongly disagree" and 6 was "strongly agree" to measure responses to a series of eleven statements about videogame play that were posed to the participants. The statements were designed to measure engagement,

addiction, conflict, and withdrawal symptoms. Skoric et al. (2009) found that participants who exhibited greater levels of video gaming addictive tendencies were significantly more likely to have lower average standardized English test scores, average standardized mathematics test scores, and average standardized science test scores. However, they went on to conclude that videogame engagement, short of addiction, did not have negative effects on academic performance.

Virou, Katsionis and Manos (2005) declare that skepticism about game-based learning has prompted researchers to conduct more empirical studies of how games can enhance learning. However, these studies are very difficult to execute due to the challenge of accounting for many complex variables (Van Eck, 2006). Girard, Ecalle, and Magnan (2013) conclude that very few studies have proven that videogames have a positive effect on learning. Young et al. (2012) highlight the positive effects of videogames in the areas of language and literacy, but are still skeptical about their effect on math, science, or overall player achievement. Young et al. (2012) reviewed over three hundred articles that related to videogames and their effect on academic achievement. They found that videogames had some positive effects on improving basic language skills and physical activity. However, they found very little support for the claim that videogames improved student performance in the areas of math and science. Finally, their analysis declared that while there are many interesting and engaging videogames, there is little evidence to support their actual impact on student academic achievement. Clark (2013) wrote an article where she declares that gaming in its present forms does not have a causal effect on instructional delivery. Clark refers to the work of Sitzmann (2011) who reviewed research studies that explored the learning effectiveness of computer-based simulation games. Sitzmann (2011) declared that simulation games were effective at increasing the motivation of participants

but additional research was needed to determine if this genre of games effectively increased knowledge mastery. Although Clark (2013) acknowledged that videogames could be effective teaching tools, she concludes that there is not a sufficient amount of empirical data, especially in her field of language learning, to prove that videogames can effectively align with specific learning goals to improve instructional delivery.

Cost and Accessibility

Ultimately, implementing game-based learning, like any other educational intervention, becomes a matter of pedagogical, administrative and financial prioritization (Gee, 2007b). The cost of the equipment, software as well as the expense of training teachers is determined by the nature, focus, and size of the proposed intervention. These factors have the potential to be considerable obstacles. The hardware choices may entail using computer labs with desktop computers, console with televisions, or handheld devices such as tablets, smartphones or dedicated portable gaming systems. De Frietas' (2006) review of COTS gaming literature revealed that one of the main barriers to implement COTS games was a lack of access to computer hardware, in particular, the availability of current graphics. De Frietas (2006) also highlighted lack of effective technical support and the cost of videogames software and licenses. Marquis (2012) suggests that the cost of popular games that are more likely resonate strongly with students could present significant challenges.

Dondi and Moretti (2007) point out that the production quality of educational videogames needs to be high in order to provide sustainable and effective platforms. This could result in potentially prohibitive costs for the consumer. Loftus (2014) elaborates on this point by highlighting that production costs for most popular console videogames include marketing expenses such as printed materials and commercials. Costs of anti-piracy code installation,

about ten dollars per unit, are passed on to publishers and consumers. Thus, most popular console titles retail for fifty to sixty dollars while the consoles retail for three to five hundred dollars each (Loftus, 2014). With these prices in mind, available funding for instructional supplies becomes an important factor. However, Marquis (2012) believes that improved accessibility and ability of playing games of mobile devices coupled with the decreasing cost of gaming consoles are leading up to a time where videogames could be a part of every classroom. The LEA where this problem of practice is being addressed allots funding for instructional supplies in the fall of each academic year and Table 4 illustrates the allotted amount to the target school for 2013-2014. Accounting for the aforementioned costs, the target school could possibly fund COTS game-based interventions.

Van Eck (2009) declares that professional development for teachers in the area of game-based instruction must incorporate support tools, specifically effective lesson planning. The demand for this training will primarily depend on the teacher's understanding of how to integrate the facets of content, gaming environment, and classroom activities. The cost of this training will be dependent on the level of expertise in any particular LEA. The target school's staff development Title 1 allotment 2014-2015 was $4,943.95. If a facilitator can be found within the existing staff, costs such as travel and presenter compensation can be mitigated (Van Eck, 2009). Training costs could also be controlled through the use of online resources such as Edutopia's game-based learning resource roundup (Edutopia, 2014).

Experience Sampling Method

Kubey, Larson, and Csikszentmihalyi (1996) declare that the experience sampling method (ESM) collects detailed data through the use of self-reporting about a participant's experience during a study. This approach produces detailed accounts of the participant's

Table 4

Target School's Instructional Supply Allotment for 2013-2014

Allotted Funds	State PRC 061 Allotment	Title I Line Item
Instructional Supplies	$8,439.00	$14,000.00

subjective perceptions, which can go beyond the capacity of many data collecting techniques, which mainly focus on data points. However, it is important to stress that these responses should be documented in a consistent manner. Kubey et al. (1996) describe the participant's subjective experiences as having an internal and external dimension. The internal dimension describes how a participant thinks or feels during a study while the external dimension focuses on the physical aspects of the study such as time of day and grouping of participants. These dimensions help to provide an accurate assessment of the participant's behavior or mood while completing a reporting activity.

Kubey and Larson (1990) have used the experience sampling method to examine the media preferences of children, including videogames. They reported that boys had higher levels of activation than girls while playing videogames. Kubey and Larson (1990) conducted a study involving four hundred and eight-three randomly chosen students from eight different Chicago area schools. The students ranged in ages from nine to fifteen years old and the study was conducted over a two-year period. The students were assigned pagers, which sent a signal every two hours between the hours of 7:30 a.m. and 9:30 p.m. The students were instructed to respond as soon as possible and to complete a short report after each receiving each signal. The students were also interviewed weekly to discuss their experiences during media related activities such as television, music, and videogames. Kubey and Larson (1990) found that students reported higher levels of arousal and attention while playing videogames. The students also reported that they were also more likely to provide a delayed response to the pager signal while playing videogames. Kubey et al. (1996) declared that this increase in attentiveness is partially created by the ability of videogames to gradually increase their difficulty level while providing responsive feedback. They described the culmination of these factors as flow experiences.

In applying the experience sampling method to the educational field, Zirkel, Garcia, and Murphy (2015) declare that this methodology offers some pertinent advantages. They claim that ESM reaches subjective experiences that most research methods cannot probe by providing a closer proximity to the participants' experience since the data are collected while the experiment is happening as opposed to retrieving data after the intervention end. Zirkel et al. (2015) also point out the capability of ESM to describe a large number of participant experience and the ability to apply behaviors and thoughts in a specific context. Last, they point out that the repeated data gathering measure as prescribed by ESM provide a greater level of statistical power when analyzing quantitative data. A modified version of the experience sampling methodology (ESM) will be used to collect qualitative data through student interviews. The details of this process will be discussed in chapter three.

Intensity of Treatment

The purpose of this section of the review of the literature is to consider the typical length of other videogame-based studies. The following studies were chosen because, like this study, they all attempt to measure the effectiveness of a videogame in a classroom setting by quantifying data and generalizing results from a sample of a targeted population. The effectiveness of the studies is mainly measured by examining the gains or losses revealed in pre and post assessments. The participants in these studies range from college aged students to elementary school students and were included to provide a clearer perspective of the varying lengths and frequency of intervention.

Blunt (2012) examined the relationship between the use of videogames and learning achievement by assigning approximately half of three college class groups the use of a management-based videogame. The other half of the class groups was used as a control group.

After the semester long classes (approximately four months) were completed, student test scores, class size, gender, ethnicity, and age were collected as data points. After completing a game tutorial, classes that used the game played for two hours every other class period. The analysis found that class groups using the games had significantly higher mean scores than the class groups that did not use the games. The mean scores for students who played the game were 89.99 versus the means score of 68.42 for the students who did not play the game during the semester. However, no significant performance differences were found among gender or ethnic groups regardless of game play.

A study by Guillén-Nieto and Aleson-Carbonell (2011) examined a game called "It's a Deal!" that was designed to increase the competence of students in the area of business English. The study attempted to measure any fluctuation in the player's intercultural learning. Pre and post-test assessments were administered to one hundred and six college level participants and fifty of these students were randomly selected to play the game while being informally observed. Experienced gamers were able to complete the game in approximately ninety minutes. The average time of completion was two and a half hours. Guillén-Nieto and Aleson-Carbonell found that "It's a Deal!" had a significant learning effect. The pre-knowledge and post-knowledge tests administered by the researchers measured the three variables of intercultural awareness, intercultural knowledge, and intercultural communicative competence. The mean scores for the first variable rose from 3.2033 to 3.4267, an increase of 0.2234. The second variable's mean scores rose from 3.3167 to 3.5567, an increase of 0.24. The mean scores for the last variable rose from 3.3333 to 3.6567, an increase of 0.3234.

Mifsud, Vella, and Camilleri (2013) designed a study where pre and post assessment results were compared between two groups of students, an experimental group and a control

group, who were in an English as-a-second language class. One COTS game, the Mystery of the Missing Amulet, was chosen for eighteen classes of children from ages eleven to thirteen. The study lasted for six weeks and the daily sessions were forty minutes long. Mifsud et al. (2013) concluded that the two groups of students began the study with similar proficiency levels because the pre-test revealed no significant differences in means scores. After the game was added to the instruction of the experimental group, the study show that this group made significant gains in proficiency when compared to the control group due to the significant difference in post-test mean scores. The experimental group exhibited a 6.97 increase in mean scores from pre-test to post- test while the control group had a 0.87-drop in mean scores. As Blunt (2012) noted, no gender differences were noticed in terms of learning gains.

Tuzun, Yilmaz-Soylu, Karakus, Inal, and Kizilkaya (2009) designed and developed a three-dimensional educational computer game. In this study, twenty-four players in fourth and fifth grades in a private school in Ankara, Turkey learned about world continents and countries through this game for three weeks. The interventions were given once a week and for an hour per day. The effects of the game environment on players' achievement and motivation and related implementation issues were examined through both quantitative and qualitative methods. An analysis of pre- and post-achievement tests showed that students made significant learning gains by participating in the game-based learning environment. The post-test mean scores showed gain of 2.4 points and Tuzun et al. (2009) deemed this to be statistically significant.

Tuzun et al. utilized a scale based on the work of Lepper, Corpus and Iyengar (2005) to be measure student motivation. The scale examined seventeen items measuring intrinsic motivation and thirteen items measuring extrinsic motivation. Each of these items was measured along the dimensions of preference for challenge, curiosity, and independent mastery. The scale

was used to compare motivation levels in a traditional learning environment versus a game-based learning environment. Both versions of the scale utilized a five point Likert scale (1 = strongly disagree and 5 = strongly agree).

When comparing student motivation while learning in the game-based learning environment versus their traditional school environment, Tuzun et al. (2009) found that players demonstrated statistically significant higher intrinsic motivations and statistically significant lower extrinsic motivations learning in the game-based environment. The mean scores for intrinsic motivation showed an increase of 3.8 points, the game context mean score was 31.4 as compared the traditional context mean score of 27.6. The mean scores for extrinsic motivation showed a drop of 3.9 points while the game context mean score was 27.8 versus the traditional context mean score of 31.7.

Huizenga, Admiraal, Akkerman, and Dam (2009) examined the effectiveness of a mobile city game that sought to increase student knowledge of medieval Amsterdam. Their research design utilized an experimental group and control group structure where students in one group received the game-based intervention and the remaining students received regular, project-based lessons that were designed to mirror the content found in the game. The study involved a total of four hundred and fifty-eight students and the experimental and control groups each had a total of ten separate classes. The experimental group played the game for a total of three weeks. Huizenga et al. cited that each class played for an average six hours, or the equivalent of one school day, during this period. A knowledge test was administered after the intervention time concluded. The students who received the game-based intervention correctly answered sixty percent of the questions on the knowledge test as compared to the students who received the project-based instruction who correctly answered twenty-six percent of the questions.

Miller and Robertson (2010) employed a pre and post-test design to explore the effects of a COTS videogames on three classes of children ranging in ages from ten to eleven years. Seventy-one students participated in the study. The first class utilized a Nintendo DS based game called Dr. Kawashima's Brain Training Game for twenty minutes each day over a ten-week intervention period. Two comparison groups were used. The second class used a series of physical movements called Brain Gym that claims to promote neurological re-patterning, and whole-brain learning. The third class received no treatment and acted as a control group. Miller and Robertson employed a one hundred item test dubbed the Number Challenge in order to measure the students' mental computation. All three groups saw a gain in mean scores during the intervention period but he group that utilized the brain training game had the highest gain. Their mean scores rose from 76.19 to 86.38, a 10.19 gain. The group that employed the brain gym exercise had the smallest gain. Their mean scores rose from 70.94 to 72.71, a 1.77 gain. The group that received no treatment had a 4.74 gain, from 72.63 to 77.37.

Some time later, Miller and Robertson (2011) conducted a similar study with a larger group. This time, six hundred and thirty-four students ranging in ages from ten to eleven years were split into two groups, an experimental group and a control group. The students in the experimental group still used Dr. Kawashima's Brain Training Game for twenty minutes each day but the intervention period was shortened to a nine-week intervention period. The control group received no treatment during the intervention period. Again, a pre and post-test design and the one hundred-item Number Challenge were employed. However, no significant gains were found between the experimental and control groups in relation to mental computation. The mean scores for the experimental group rose from 78.56 to 83.04, a 4.48 gain. The mean scores for the control group rose from 78.74 to 81.65, a 2.91 gain.

Table 5 displays a comparison of the age of the participants along with the length and frequency of intervention. An examination of this table reveals that this proposed study, which is noted at the bottom, has a similar intensity of intervention.

Table 5

A Comparison of Game Based Case Study Intervention Time

Researchers	Age of Participants in Study	Length & Frequency of Intervention	Total Intervention Time in Hours
Blunt (2012)	College students	Sixteen weeks total. Two hours each week.	Thirty-two hours per student.
Guillén-Nieto & Aleson-Carbonell (2011)	College students	Ninety minutes to two and a half hours. Length of time to complete the game.	Ninety minutes to two and a half hours per student.
Huizenga, Admiraal, Akkerman & ten Dam (2009)	Twelve to sixteen years	Six hours of play during the three-week long intervention.	Six hours per student.
Mifsud, Vella & Camilleri (2013)	Eleven to thirteen years	Six weeks total. Forty-minute daily sessions.	Twenty-two and a half hours per student.
Tuzun, Yilmaz-Soylu, Karaku, Inal, & Kizilkaya (2009)	Fourth and fifth grade students - nine to eleven years	Twelve weeks total. One day per week and one hour per day.	Twelve hours per student.
Miller & Robertson (2010)	Ten to eleven years	Ten weeks total. Twenty minutes per day.	Sixteen hours and forty-minutes per student.
Miller & Robertson (2011)	Ten to eleven years	Nine weeks total. Twenty minutes per day.	Fifteen hours per student.
Parker (2015)	Third grade students - seven to nine years	Sixteen weeks total. Eight weeks per group. Thirty-minute sessions twice per week.	Eight hours per student.

CHAPTER THREE: METHODOLOGY

The LEA in which this study was conducted serves one county in rural eastern North Carolina with a population of almost twenty-four thousand people (Commerce, 2012). The LEA has two high schools that serve grades nine through twelve, two middle schools that serve grades six through eight, three elementary schools, including the target the school, that serve pre-kindergarten through fifth grade, one elementary school that serves pre-kindergarten through sixth grade, one pre-kindergarten through second grade, and, one third through fifth grade school. The county has one charter school that serves sixth through twelfth grades. The average household income in this county is almost ten thousand dollars less per year than the state average (Commerce, 2012). The percentage of students who have qualified for free-and reduced-priced lunch in the target school was 73% for 2012-2013 while the county average for the same period was 60% (Kinion, 2013).

Participants

In keeping with the problem of practice identified by the LEA's assistant superintendent, the participants of this study were third grade students in one school. At the beginning of the study, there were thirty-six students (fourteen boys and twenty-two girls) in the target school's 2014-2015 cohort. The students were split into two groups containing eighteen students. Since these groups also served as third grade homerooms, the students were divided in a manner to keep the class sizes as even (in terms of numbers) as possible. The same treatment was also applied to the gender balance in each group. There were seven boys and eleven girls in each group. The age of the students in this cohort range from seven to nine years old. There were five students in this cohort that have an identified disability that necessitates the implementation of an individual educational plan (IEP). After consulting with the school district's exceptional

children's' staff, these students were excluded from the participant group because their daily schedules require varied amounts of time out of the regular classroom setting. Each participant provided informed assent documentation, and each participant's caregiving adult (parent/guardian) provided informed consent documentation prior to being included in this study (see Appendix C).

Intervention

The research design of this action research study utilized pre - and post- assessment to measure the effectiveness of students' involvement with "Scribblenauts Unlimited" on literacy skills as measured by Reading 3D data. The intervention time-line consisted of sixteen weeks of intervention during which two sections of students alternated the roles of intervention and control groups at the eight-week mark. The point of this time allocation was to provide a measure of effectiveness of the treatment (Did the treatment group exhibit a greater positive change than the control group after eight weeks?), while also providing access to the intervention (which is expected to enhance learning) to the initial control group. Table 6 illustrates the way in which the two sections of students provided a level of control on the effect of the intervention.

This experimental research design was modeled on the switching-replications design, which Trochim (2001) describes as one of the strongest of the experimental designs. He bases that statement on the fact that, in circumstances such as this study, it addresses the drawback of having to deny treatment to half of the study participants. Using random assignment is not feasible in this school situation, so, using the conventional research design notation, this study would be depicted as shown in Table 7. The initial observation (represented by the column of O's situated towards the left side of the graph) will be the beginning-of-year (BOY) assessment outcomes, the intermediate observation (represented by the column of O's in the middle of the

Table 6

Split Involvement in the Intervention as a Control Measure

	Section 1	Section 2
First Eight Weeks	"Scribblenauts Unlimited"	Conventional literacy instruction
Second Eight Weeks	Conventional literacy instruction	"Scribblenauts Unlimited"

Table 7

Switching-Replications Study Design with Non-Equivalent Initial Assignment

Intervention Periods	BOY Outcomes	1st Experimental Group Assignment	8 Weeks Outcomes	2nd Experimental Group Assignment	MOY Outcomes
N	O	X	O		O
N	O		O	X	O

graph) consisted of the eight-week assessment outcomes, and the final observation (represented by the column of O's situated toward the right side of the graph) consisted of the middle-of-year assessment outcomes (MOY). The X's in the graph represented the control and experimental groups and the N's at the beginning of each row represent each eight-week intervention period. These quantitative measures of effectiveness were supplemented by extensive qualitative data collection and analysis, as discussed later in the chapter.

The LEA level technology staff and school level administrators facilitated the intervention's preparation process. The "Scribblenauts Unlimited" videogame were installed onto each PC desktop computer in a laboratory. Each computer had an icon located on the desktop that participants double-clicked with the computer mouse's left button to open the program. After participants logged in to their computers, they used headphones instead of computer speakers when they were in a "Scribblenauts Unlimited" session. The game's technical specifications are listed in Table 8.

Implementation

The intervention was implemented for one hour per week for two eight-week cycles during student computer laboratory times. The target school's computer laboratory schedule was adapted to accommodate this sixteen-week study. The one-hour per week exposure was divided into two thirty-minute sessions, one on each of two days each week. The "Scribblenauts Unlimited" sessions were complementary to the LEA prescribed grade three computer-based remediation program called SuccessMaker. Thus, the intervention was delivered in a similar medium to many of the participants "normal" class work. This enhanced the similarity of the "control" environment for the section not involved with "Scribblenauts Unlimited" for the assigned eight-week time slot.

Table 8

Minimum Technical Specifications for "Scribblenauts Unlimited"

Online Modes	Broadband Internet Connection
Hard Drive Space	Two gigabytes of Available Hard Drive Space
Operating System	Windows® XP or higher
Processor	2.0 GHz AMD Athlon 64 X2 Dual-Core 4000+ / Intel Core 2 Duo Processor or better
RAM	Two gigabytes of available system memory
Video Card	256 MB Video Card w/ Shader Model 3.0 or better (ATI X1800 or better / NVIDIA 7800 or better / Intel 4100 or better)

The school schedule time-slots were forty-five minutes long. The extra time 15 minutes allowed participants who used "Scribblenauts Unlimited" enough time to enter the computer lab, get seated, and login while preserving thirty-minutes of gameplay. This cohort of students has been required to utilize an online learning program called Waterford for at least fifteen minutes per day, five days per week in kindergarten and thirty minutes per day, five days per week, in first and second grades. Therefore, it is reasonable to assume that students are familiar with the computer laboratory's login procedures.

Game Description

"Scribblenauts Unlimited" for PC was released on November 19, 2012. The game begins with a story that charges the protagonist, Maxwell, with the responsibility of releasing his sister, Lily, from a spell that has turned her into stone. Maxwell's avatar is shown in Figure 4, and Lily's avatar is shown in Figure 5. Maxwell helped to bring on this curse on his sister by playing a prank on a townsperson with the use of his magic notebook. Now, he must use the notebook in a philanthropic manner in order to rescue Lily from her fate. Maxwell's quest is focused on the pursuit of starites. Starites are magical stars that appear when Maxwell solves short puzzles for the townspeople's benefit. Each puzzle requires the participant to input an appropriate noun and manipulate each object with computer mouse clicks in order to earn a starite. The acquisition of each starite brings Maxwell closer to reversing Lily's curse (Scribblenauts, 2012). The game begins with the same level of difficulty for all participants and the challenge gradually increases as each participant completes each stage.

The game's database of twenty-two thousand eight hundred words allows participants to write most any noun they can think of and watch as it comes to life through a predictive spelling algorithm called "Objectnaut" (Broder, 2009). Each noun entered by the participant retrieves a

Retrieved from http://www.gamestop.com/pc/games/scribblenauts-unlimited/104951

Figure 4. Box art from "Scribblenauts Unlimited" for PC featuring the story's protagonist, Maxwell.

Retrieved from http://www.gamestop.com/pc/games/scribblenauts-unlimited/104951

Figure 5. The Lily avatar game character (Maxwell's sister).

graphic representation of the noun object from the game's database, and the object behaves as it would in the real or imaginary world. In addition, participants can combine countless objects to create completely new scenarios. Not only can players create their own imaginary items, there is an innovative objects editor system that allows players to choose from thousands of options to change his or her chosen object in multiple ways. Participants may use adjectives to changes the color, size, style, behaviors, and many other aspects of objects, and participants may even use multiple adjectives together to create individualized objects as they progress through each level. A depiction of the objects editor system can be found in Figure 6.

"Scribblenauts Unlimited" encourages participants to exercise a great deal of creative flair. This study is focused on whether involvement in the game leads to an increase in reading comprehension and literacy skills. If such as increase is detected, it may be because the game allows participants to associate and apply their expanding vocabulary to the game's plot points as they solve each puzzle (Scribblenauts, 2012). The data collection section will discuss how students' insights into their involvement with "Scribblenauts Unlimited" will be determined.

While participants may create nearly any item that they can think of in order to solve the puzzles, it is important to note that the system incorporates restrictions. To wit, the game will not accept vulgarities, alcoholic references, proper nouns, or copyrighted materials. The game also omits some words that appear to be fairly innocuous. For example, participants can create bishops or ministers, but popes are not in the database.

Data Collection

Data for this study was obtained from both quantitative and qualitative sources.

Retrieved from http://www.gamestop.com/pc/games/scribblenauts-unlimited/104951

Figure 6. The objects editor system, showing a dragon with leave for wings and branches for legs.

Quantitative Data

The quantitative data consisted of participant's scores on the Reading 3D assessment that were analyzed after the completion of the middle of year assessment in January of 2015. Specifically, the text reading and comprehension (TRC) data was analyzed to determine the change in each participant's reading comprehension. The Reading 3D TRC goals for third grade students begin with level G at beginning of year (BOY), rising to level M at middle of year (MOY), and end with level P at end of year (EOY). In this study, TRC changes were calculated by tracking the number of letter levels that each participant has changed from BOY to MOY.

The dynamic indicators of basic early literacy skills (DIBELS) were examined in the areas of fluency, accuracy, retell, and daze. Daze refers to a series of procedures that measure the reasoning behind reading comprehension by examining a student's word recognition skills and his or her ability to use background information to understand a passage. The change in each participant's DIBELS scores in each area between the BOY and MOY assessment periods were calculated by adding or subtracting from his or her previous score. For example, if a participant received a fluency score of twenty-five after the BOY assessment period and then earned a score of thirty after the MOY assessment period, then the participant exhibited a five point gain during the intervention. This methodology was also applied to the areas of DIBELS accuracy, retell and daze.

At the end of the first eight weeks, as shown in Table 6, Section 1 participants completed their work on "Scribblenauts Unlimited." At this point in time, the achievement of all participants in the study was recorded to enable the comparison of reading achievement changes between the two groups. This progress monitoring determined the outcome of participants' Reading 3D levels between the beginning-of-year (BOY) and the eight-week milestone, and

enabled comparison of the achievement between the Section 1 (intervention) and Section 2 (control) groups. As shown in Table 6, for the second eight weeks, Section 1 acted as the control group and Section 2 was the intervening group. At the middle-of-year (MOY) stage, the Reading 3D data was again analyzed to compare the relative achievement of the participants in Section 1 (now control) and Section 2 (now intervention). In general, achievement was compared at the whole group level, and then at the level of gender and race (provided that there are more than five participants in each category). All data displays maintained confidentiality.

Qualitative Data

The quantitative data was illuminated by extensive qualitative data gathered by means of video observations of selected small groups of students, "think aloud" viewing of selected video excerpts by selected participants, snapshot insights into individual participants' learning experiences by means of experience sampling methodology (Csikszentmihalyi & Larson, 1987) and end-of-study-segment surveys (Fang, Zhang, & Chan, 2013). Each of these approaches is described below.

Video observations of selected small groups of students. A video camera was set up in the computer laboratory and focused on a small group of four or five participants. These videos were edited to highlighted learning events that seemed to be particularly relevant to this study. The edited videos were then coded in NVivo from a grounded theory perspective.

"Think aloud" viewing of selected video excerpts by selected participants. One or two of the members of the group on which the video camera was focused were invited to "think aloud" through excerpts of the edited videos. The aim was to capture the participants' learning experience in their own words at what they seemed to be key points of their learning trajectory.

These “think aloud” sessions were voice-recorded and coded in NVivo from a grounded theory perspective.

Experience sampling method. Kubey, Larson and Csikszentmihalyi (1996) utilized the experience sampling method (ESM) extensively to gain insights into participants’ experience in real time. In this study, ESM was employed through the use of short surveys (see Appendixes E, F, G & H) distributed twice during each half-hour “Scribblenauts Unlimited” learning session to the members of the small group on which the video camera is focused. The ESM surveys were printed on sheets of paper and handed to all members of the small group during the “Scribblenauts Unlimited” sessions at random intervals. The results of the ESM surveys were entered into an Excel spreadsheet on that particular participant’s page. The intention was to sample each participant’s experience many times over the course of the intervention window, and to correlate this data with the participants’ academic achievement outcomes.

End-of-study-segment survey. At the end of each eight-week intervention session, a survey designed to measure the extent to which participants experienced flow during “Scribblenauts Unlimited” was administered to the participants in the intervention. The survey was based on the work of Fang et al. (2013). Based on the technological infrastructure of the target school, the survey was administered in the form of a Google document.

Similar to the process employed by Fang et al. (2013), the main objective was to employ an instrument that was understandable to its target audience, and addressed all of the elements of flow. The Lexile levels of each item were used to objectively determine whether they should be reworded for this study. Under the Common Core standards, the Lexile levels for third-grade college and career ready students ranged from 520L to 820L with a median of 670L (Lexile, 2014). Therefore, the aim of this process was reword all items with a Lexile level over 820L.

Consequently, three items were reworded. One of the main goals of this rewording process was to preserve the sentence structure of each item as much as possible.

The first item to be reworded was "I find that playing this game stretches my capabilities to my limits" which has a Lexile level of 840L. Changing the word "capabilities" to "abilities" reduced the Lexile level to 820L so the amended version to be used in the instrument will be "I find that playing this game stretches my abilities to my limits." The second item to be reworded was "I was challenged by this game, but I believed I am able to overcome these challenges" which has a Lexile level of 970L. In order to lower to Lexile level to 780L, the latter part of the item was altered. The words "believed I am able to" were removed and the word "can" was inserted. Thus, the version that will be used in the summative instrument will be "I was challenged by this game, but I can overcome these challenges." The third and last item to be reworded was "I often find myself doing things spontaneously and automatically without having to think" which has a Lexile level of 900L. Removing the words "spontaneously and" reduced the Lexile level to 750L so the version will be "I often find myself doing things automatically without having to think." The full text of the end-of-study instrument is included as Appendix F.

A seven-point Likert scale, where "1" will be labeled "low," "4" was labeled "undecided," and "7" was labeled "high," was utilized to record student responses. Students had the option to choose the intermediate data points (2, 3, 5, and 6) to indicate degrees of opinion (see Appendix F). These data were correlated with the participant's academic achievement data, and considered in the context of the ESM data.

CHAPTER FOUR: RESULTS

Chapter 4 presents the findings of the non-random crossover design implemented in this study. As discussed earlier, this study utilized a mixed-methods approach, and the quantitative findings will be discussed before turning to the qualitative findings and the ways in which the findings from each approach informs the findings of the other.

Using the conventional notational symbols, this study would be characterized as shown in Table 9. As discussed earlier, the two groups of participants were members of already established classes, so random assignment was not feasible. The same test batteries (consisting of six sub-tests) were used on all three testing occasions, and each intervention/control cycle was eight weeks long.

Demographic Comparability

The participants in this study were class members of existing classes in an elementary school whose parents consented and who then also individually assented to participate in this study. Hence, it was not feasible to match ability levels or randomly assign students to groups, and initial nonequivalence between the groups was anticipated.

However, in terms of the demographic characteristics collected for this study (gender and ethnicity), a visual inspection of Group A and Group B characteristics suggests some similarity between them. For example, as the histogram bars in Figure 7 illustrate, while Group A (shown in darker shading) contains two more students than Group B, the proportions of each of the gender and ethnicity histogram bars appear to be comparable.

Reading Achievement Comparability: Baseline

Reading 3D data were generated at the Beginning of Year (BOY) period, which began September 2, 2014 and concluded on September 22, 2014. The data were then progress

Table 9

Conventional Study Design Diagram

Intervention Periods	BOY Outcomes	1st Experimental Group Assignment	8 Weeks Outcomes	2nd Experimental Group Assignment	MOY Outcomes
NR1	T11.1-11.6	I	T12.1-12.6	C	T13.1-13.6
NR2	T21.1-21.6	C	T22.1-22.6	I	T23.1-23.6

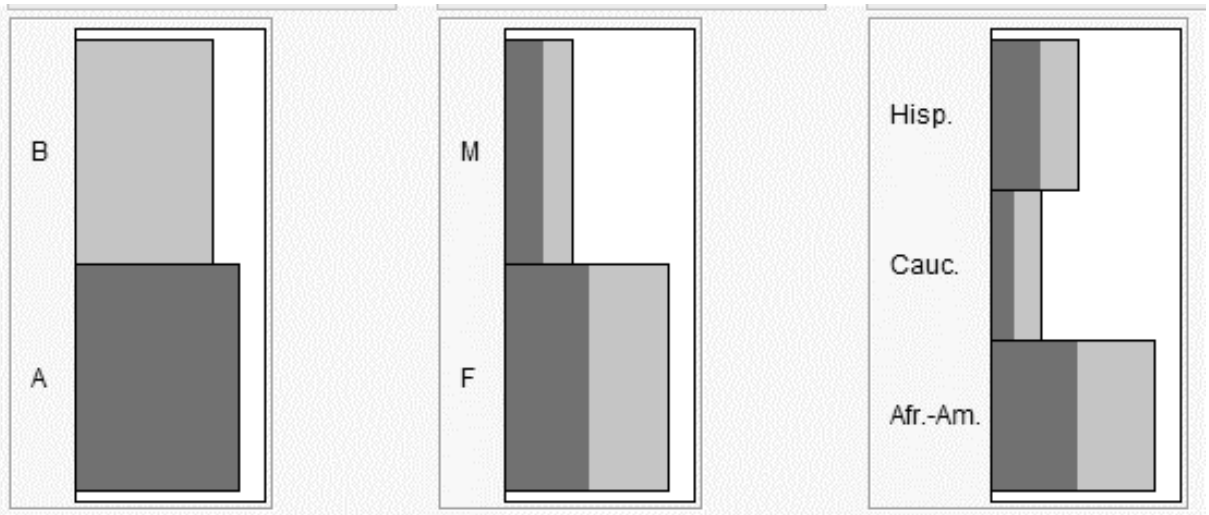


Figure 7. Visually comparable proportions of histogram bars for gender (female = F, male = M) and ethnicity (Hispanic = "Hisp.," Caucasian = "Cauc.," African American = "Afr-Am.") suggest Group A and B are somewhat similar in demographics.

monitored at the eight-week mark. Progress monitoring was completed from November 10, 2014 to November 21, 2014. The data were analyzed as the component scores: Text and Reading Comprehension (TRC), Dibels Accuracy, Dibels Fluency, Dibels Retell and Dibels DAZE.

The Text Reading Comprehension (TRC) achievement measure is a composite of reading comprehension measures that utilize leveled booklets to determine each student's instructional reading level. The leveled booklets are specific to each student's reading level, and are expressed as a letter of the alphabet. There is no published basis for considering the letters to be evenly spaced across the achievement spectrum. In other words, there is no published basis for considering the difference in achievement between a student at Level M and another student at Level N as being the same as the difference between a student at Level O and another student at Level P.

For the purpose of analysis, each letter was assigned its numerical position in the alphabet. Hence, Level N was assigned 14, Level F was assigned 5, and so forth. Applying this transcription to the beginning-of-year data, the TRC achievement data show Group A (M = 12.92, s = 3.66) to be the practical equivalent of Group B (M = 13.00, s = 3.10), based on a specified practical difference threshold of three points (upper threshold t ratio = -2.09, p = .0243; lower threshold t ratio = 2.20, p = .0194). The wisdom of specifying the practical difference threshold as the same order of magnitude as the standard deviations of the two groups is open to debate. In this context, the practical equivalence of the two groups at a three-point threshold is more a finding of interest than a foundation for further theorizing, as measures of the effectiveness of the intervention will be based on change scores.

Specifying a 5-point threshold as indicating practical equivalence (approximately 5% of the score range), Group A was not practically equivalent to Group B on any of the Dibels components. The absolute differences between the means for Fluency, Accuracy, and Retell (with the standard error of the difference in parentheses) were 12.24 (11.27), 1.48 (4.34), 0.13 (7.80) respectively. Specifying a one-point threshold for the DAZE scores (again, approximately 5% of the score range) similarly indicated that there was no practical equivalence between the two groups (absolute difference between the means = 1.71, standard error of difference = 1.67).

First Intervention Cycle

Utilizing a matched-pairs *t* test, both Group A (M = 12.92 to M = 13.46; t = 3.74, p = .0014) and Group B (M = 13.0 to M = 13.82; t = 6.71, $p < .0001$) participants recorded gains in TRC scores across the first eight weeks of the study.

Both Group A and Group B participants recorded gains in Dibels scores across the first eight weeks of this study. Utilizing a matched-pairs *t* test, participants in Group A (intervention) recorded statistically significant mean gains across all four Dibels components: Fluency (M = 69.69 to M = 95.0; t = 5.50, $p < .0001$), Accuracy (M = 90.62 to M = 93.23; t = 2.30, p = .0200), Retell (M = 39.69 to M = 48.69; t = 3.10, p = .0046), and DAZE (M = 4.92 to M = 7.62; t = 1.98, p = .0356).

However, participants in Group B (control), again utilizing a matched-pairs *t* test recorded statistically significant mean gains for only the Fluency (M = 57.45 to M = 82.18; t = 8.44, $p < .0001$) and Accuracy (M = 92.10 to M = 96.18; t = 2.79, p = .0096) components.

Analysis of the change scores from beginning-of-year to the end of the first eight-week cycle of the study utilizing the Wilcoxon test indicated that there was no significant difference between Group A and Group B participants with respect to any of the TRC, Fluency, Accuracy,

Retell, and DAZE overall change scores. In other words, the changes in achievement recorded by the participants in Group A (intervention) did not outstrip the changes in achievement recorded by the participants in Group B (control).

Second Intervention Cycle

In the second eight-week intervention cycle, Group B participants were the intervention group, and Group A reverted to being the control group. Utilizing a matched-pairs *t* test, participants in Group A did not statistically significantly improve their TRC scores across the second eight weeks of the study (although there was a mean gain of 0.5 points), whereas participants in Group B did significantly improve (from $M = 13.82$ to $M = 14.73$; $t = 2.47$, $p = .0166$).

Both Group A and Group B participants recorded statistically significant decreases in Dibels Fluency, Accuracy, and Retell mean scores during the second eight weeks of this study. It is important to note here that a different assessor performed the MOY or end assessment that the person who facilitated the BOY and eight-week assessment. This change in testing protocol was mandated by the LEA's kindergarten through fifth grade curriculum director prior to the district-wide administration of the MOY assessment.

For Group A, utilizing the matched-pairs *t* test, statistically significant mean score losses were recorded for Fluency ($M = 95$ to $M = 74.62$; $t = 4.76$, $p = .0002$), Accuracy ($M = 93.23$ to $M = 90.54$; $t = 2.39$, $p = .0172$), and Retell ($M = 48.69$ to $M = 23.46$; $t = 6.34$, $p < .0001$). For Group B, statistically significant mean score losses were recorded for Fluency ($M = 82.18$ to $M = 73.91$; $t = 2.42$, $p = .0182$), Accuracy ($M = 96.18$ to $M = 93.27$; $t = 2.01$, $p = .0362$), and Retell ($M = 44.55$ to $M = 29.45$; $t = 2.94$, $p = .0074$).

Only Group B students recorded a statistically significant gain in mean score on the Dibels DAZE component (M = 5.45 to M = 8.73; t = 2.57, p = .0139).

Given the outcomes of the second eight-week segment, there are no gain scores to compare across the groups.

Averaged Changes in Quantitative Data - First Eight Weeks of Study

After the first eight weeks of intervention, Reading 3D Text and Reading Comprehension (TRC) scores for the first eight weeks revealed more average growth in the control group as compared to intervention group. In the overall TRC scores, the control group averaged a 0.27 point growth advantage over the intervention group. These scores were also reflected in the gender and ethnicity categories. The girls of the control group grew 0.2 points more than their female counterparts in the intervention group. The boys in the control group grew 0.5 points than the boys in the intervention group. The African-American students in the control group grew 0.39 points than the African-American students in the intervention group. The Caucasian students in the control group grew a half point more than their intervention group counterparts and the Hispanic students in both groups exhibited one point of group in overall TRC. These scores are depicted in Table 10.

The students in the control group also exhibited higher levels of growth in the area of Dibels Fluency than the students in the intervention group after the first eight weeks of intervention. The overall Dibels Fluency data showed that the control group had 2.42 more points of growth than the intervention group. The gender data was split. The girls of the control group showed 2.47 more points of comparative growth while the boys of the intervention group showed 7.67 more points of growth than their counterparts in the control group. The ethnicity

Table 10

Reading 3D TRC Data Comparison for First Eight Weeks

	Group A Intervention - start	Group A Intervention - 8 weeks	Difference	Group B Control - start	Group B Control - 8 weeks	Difference
TRC overall	12.92	13.46	0.54	13	13.81	0.81
TRC Gender - Female	12.33	12.88	0.55	13.87	14.62	0.75
TRC Gender - Male	14.25	14.75	0.5	10.66	11.66	1
TRC Ethnicity - African-American	11.57	11.85	0.28	11.83	12.5	0.67
TRC Ethnicity - Caucasian	15.5	16	0.5	13.5	14.5	1
TRC Ethnicity - Hispanic	14	15	1	15	16	1

numbers were also split. While the African-American students in the control group exhibited higher levels of growth, 1.3 points, the Caucasian and Hispanic students who participated in the intervention group had more growth during the first eight-week period, 6 points and 0.91 points respectively. These data are shown in Table 11.

Table 12 shows that Dibels Accuracy data also yielded a higher level of growth for the control group (4.09 average growth) as compared to the intervention group (2.62 average growth). The female students in the control group averaged 0.14 more points of growth than the intervention group. The male students in the control group averaged 4.84 more points of growth than the intervention group. Once again, the ethnicity data was split. The African-American students in the control group averaged 3.07 more points of comparative growth and the Caucasian students in the control group average 1 more point of comparative growth. However, the Hispanic students in the intervention group averaged 0.34 points of growth while the control group students actually lost an average of 0.67 points.

According to the overall Dibels Retell data, the students in the intervention group averaged more overall growth (9 points) than their counterparts in the control group (4.73 points). The data are shown in Table 13. The gender data showed growth in both areas. The girls in the intervention group averaged 4.43 more points of growth while the boys in the intervention group averaged 3.67 more points of comparative growth. Again, the ethnicity data is split. While the African-American students in the control group averaged 0.21 points more growth than the intervention group, the Caucasian and Hispanic students who received the intervention during the first eight weeks averaged one point and 15.16 points of growth respectively than their peers in the control group.

Table 11

Reading 3D Dibels Fluency Data Comparison for First Eight Weeks

	Group A Intervention - start	Group A Intervention - 8 weeks	Difference	Group B Control - start	Group B Control - 8 weeks	Difference
Dibels Fluency Overall	69.69	95	25.31	54.45	82.18	27.73
Dibels Fluency Gender - Female	72.88	95.66	22.78	60.12	85.37	25.25
Dibels Fluency Gender - Male	62.5	93.5	31	50.33	73.66	23.33
Dibels Fluency Ethnicity - African-American	61.85	83.71	21.86	49	72.16	23.16
Dibels Fluency Ethnicity - Caucasian	93.5	125	31.5	58.5	84	25.5
Dibels Fluency Ethnicity - Hispanic	71.5	99.75	28.25	73.66	101	27.34

Table 12

Reading 3D Dibels Accuracy Data Comparison for First Eight Weeks

	Group A Intervention - start	Group A Intervention - 8 weeks	Difference	Group B Control - start	Group B Control - 8 weeks	Difference
Dibels Accuracy Overall	90.61	93.23	2.62	92.09	96.18	4.09
Dibels Accuracy Gender - Female	88.66	91.77	3.11	92.62	95.87	3.25
Dibels Accuracy Gender - Male	95	96.5	1.5	90.66	97	6.34
Dibels Accuracy Ethnicity - African-American	86.28	89.71	3.43	89.5	96	6.5
Dibels Accuracy Ethnicity - Caucasian	95	98	3	93.5	97.5	4
Dibels Accuracy Ethnicity - Hispanic	96	97	1	96.33	95.66	-0.67

Table 13

Reading 3D Dibels Retell Data Comparison for First Eight Weeks

	Group A Intervention - start	Group A Intervention - 8 weeks	Difference	Group B Control - start	Group B Control - 8 weeks	Difference
Dibels Retell Overall	39.69	48.69	9	39.81	44.54	4.73
Dibels Retell Gender - Female	42.88	51.44	8.56	45.37	49.5	4.13
Dibels Retell Gender - Male	32.5	42.5	10	25	31.33	6.33
Dibels Retell Ethnicity - African-American	33.42	43.71	10.29	37.16	47.66	10.5
Dibels Retell Ethnicity - Caucasian	53	58.5	5.5	28.5	33	4.5
Dibels Retell Ethnicity - Hispanic	44	52.5	8.5	52.66	46	-6.66

After the first eight weeks, the overall Dibels DAZE data revealed that the students in the intervention group averaged higher levels of growth, a gain of 3.87 points, over the control group. The girls in the intervention group averaged 3.76 points more comparative growth while the boys averaged 4.25 more points of comparative growth. In a departure from the previous Dibels categories, all three ethnic groups in the intervention group displayed higher levels of average growth in DAZE. The African-American students averaged 3.33 more points of comparative growth. The Caucasian students averaged 8.5 more points of comparative growth, and the Hispanic students averaged 11.32 more points of comparative growth than the students in the control group. The data are displayed in Table 14.

Averaged Changes in Quantitative Data - Second Eight Weeks of Study

The overall Reading 3D Text and Reading Comprehension (TRC) scores for the second eight weeks revealed more averaged growth in the intervention group (Group B) as compared to the control group (Group A). These scores are depicted in Table 15. The intervention group averaged 0.9 points of growth compared to 0.53 points of growth for the control group. There were mixed results in terms of gender where the boys in the intervention group averaged more growth than the girls. The boys in the intervention group grew an average of 1.66 points while the boys in the control group averaged zero points of growth. Conversely, the girls in the intervention averaged a lower amount of growth, 0.62 points, in the intervention group than the control group, 0.77 points. The African-American students averaged equal amounts, one point, of growth in the control and intervention groups. The Caucasian students in the control group grew a half point more than their intervention group counterparts and the Hispanic students in the intervention group averaged one-half point more growth than their counterparts in the control group.

Table 14

Reading 3D Dibels DAZE Data Comparison for First Eight Weeks

	Group A Intervention - start	Group A Intervention - 8 weeks	Difference	Group B Control - start	Group B Control - 8 weeks	Difference
Dibels DAZE Overall	4.92	7.61	2.69	6.63	5.45	-1.18
Dibels DAZE Gender - Female	4.88	7.77	2.89	6.62	5.75	-0.87
Dibels DAZE Gender - Male	5	7.25	2.25	6.66	4.66	-2
Dibels DAZE Ethnicity - African-American	5.57	6.57	1	6.16	3.83	-2.33
Dibels DAZE Ethnicity - Caucasian	3	14.5	11.5	3.5	6.5	3
Dibels DAZE Ethnicity - Hispanic	4.75	6	1.25	9.66	8	-1.66

Table 15

Reading 3D TRC Data Comparison for Second Eight Weeks

	Group A Control - 8 weeks	Group A Control - end	Difference	Group B Intervention - 8 weeks	Group B Intervention - end	Difference
TRC overall	13.46	14	0.53	13.81	14.72	0.9
TRC Gender - Female	12.88	13.66	0.77	14.62	15.25	0.62
TRC Gender - Male	14.75	14.75	0	11.66	13.33	1.66
TRC Ethnicity - African-American	11.85	12.85	1	12.5	13.5	1
TRC Ethnicity - Caucasian	16	17	1	14.5	15	0.5
TRC Ethnicity - Hispanic	15	14.5	-0.5	16	17	1

Table 16 shows that both the intervention and control groups showed losses in growth the area of Dibels fluency. However, the students in the intervention group exhibited less losses of growth than the students in the control group. The overall Dibels Fluency data showed that the intervention group averaged -8.27 points of growth while the control group averaged -20.38 points. The gender data also revealed lower levels of average losses in growth than the intervention group. The girls of the intervention group showed 8.88 less points of loss than girls in the control group while the boys of the intervention group showed 18.4 more points of growth than their counterparts in the control group. In terms of ethnicity, each intervention group displayed lower amounts of loss than each control group. The African-American students exhibited 7.78 less points of loss, the Caucasian students showed 7 less points of loss, and the Hispanic students showed 22.59 less points of loss.

In the area of Dibels accuracy, both groups also showed losses in growth. In overall Dibels accuracy, the participants in the control group had a lower amount of loss, -2.69 points, than the intervention group, -2.9 points. The average growth for the girls were the opposite of this result where the intervention group had lower losses, at 1.5 points, than the control group, at -2.77 points. The boys in the control group faired better than their counterparts in the intervention group where the control groups losses were -2.5 points compared to -6.66 points lost by those who participated in the intervention. The African-American students in the intervention group averaged more loss, at -4.33 points, than the participants in the control group, at -2.57 points. The Caucasian students who participated in the intervention averaged less points of loss, at 2.5 points than the four points lost by the control group. Finally, the Hispanic students in the intervention group averaged less points of loss, at 2.5 points, than those in the control group who averaged a loss of four points. These data are shown in Table 17.

Table 16

Reading 3D Dibels Fluency Data Comparison for Second Eight Weeks

	Group A Control - 8weeks	Group A Control - end	Difference	Group B Intervention - 8 weeks	Group B Intervention - end	Difference
Dibels Fluency Overall	95	74.61	-20.38	82.18	73.9	-8.27
Dibels Fluency Gender - Female	95.66	80.66	-15	85.37	79.25	-6.12
Dibels Fluency Gender - Male	93.5	61	-32.5	73.66	59.66	-14
Dibels Fluency Ethnicity - African-American	83.71	68.42	-15.28	72.16	64.66	-7.5
Dibels Fluency Ethnicity - Caucasian	125	106.5	-18.5	84	72.5	-11.5
Dibels Fluency Ethnicity - Hispanic	99.75	69.5	-30.25	101	93.33	-7.66

Table 17

Reading 3D Dibels Accuracy Data Comparison for Second Eight Weeks

	Group A Control - 8 weeks	Group A Control - end	Difference	Group B Intervention - 8 weeks	Group B Intervention - end	Difference
Dibels Accuracy Overall	93.23	90.53	-2.69	96.18	93.72	-2.9
Dibels Accuracy Gender - Female	91.77	89	-2.77	95.87	94.37	-1.5
Dibels Accuracy Gender - Male	96.5	94	-2.5	97	90.33	-6.66
Dibels Accuracy Ethnicity - African-American	89.71	87.14	-2.57	96	91.66	-4.33
Dibels Accuracy Ethnicity - Caucasian	98	94	-4	97.5	95	-2.5
Dibels Accuracy Ethnicity - Hispanic	97	94.75	-2.25	95.66	95.33	-0.33

In the area of Dibels retell, both groups also showed losses in growth in the intervention group. These figures are shown in Table 18. In overall Dibels retell, the participants in the control group had a higher amount of loss, -25.23 points, than the intervention group, -15.09 points. The gender results for this study both showed less averaged loss in the intervention group as opposed to the control group. The girls in the intervention group averaged losses of -14.62 points in the intervention group while their counterparts in the control group averaged 25.11 points of loss. The boys had a similar trend here where in the intervention group, they averaged losses of -16.33 points compared to -25.5 points lost by those who participated in the control group. All studied ethnic group exhibit the same trend of lower loss averages in the intervention group. The African-American students in the intervention group averaged less loss, at 20 points, than the participants in the control group, at 21.57 points. The Caucasian students who participated in the intervention average less points of loss, at 10.5 points than the 19 points lost by the control group. Finally, the Hispanic students in the intervention group averaged less points of loss, at 8.33 points, than those in the control group who averaged a loss of 34.75 points.

With the exception of some areas of ethnicity, the Dibels DAZE data revealed that the participants showed higher amounts of growth in the intervention group. In overall Dibels DAZE, the participants in the intervention group had a higher amount of growth, 3.27 points, than the intervention group, 2.92 points. The gender results also showed more in the intervention group as opposed to the control group. The girls in the intervention group averaged 3.37 points of growth while their counterparts in the control group averaged 3 points of growth. The boys had a similar trend. In the intervention group, they averaged 3 points compared to 2.75 points gained by those who participated in the control group. Two areas of ethnicity data exhibited the opposite trend where the control group averaged higher growth. The African-American students

Table 18

Reading 3D Dibels Retell Data Comparison for Second Eight Weeks

	Group A Control - 8 weeks	Group A Control - end	Difference	Group B Intervention - 8 weeks	Group B Intervention - end	Difference
Dibels Retell Overall	48.69	23.46	-25.23	44.54	29.45	-15.09
Dibels Retell Gender - Female	51.44	23.66	-25.11	49.5	34.87	-14.62
Dibels Retell Gender - Male	42.5	17	-25.5	31.33	15	-16.33
Dibels Retell Ethnicity - African-American	43.71	22.41	-21.57	47.66	27.66	-20
Dibels Retell Ethnicity - Caucasian	58.5	39.5	-19	33	22.5	-10.5
Dibels Retell Ethnicity - Hispanic	52.5	17.75	-34.75	46	37.66	-8.33

in the control group averaged 2.71 points of growth compared to -2.83 points for the control group. The Caucasian students in the control group averaged 4 points of growth while the intervention group averaged 2 points. However, the Hispanic students in the intervention group averaged more growth, 5 points, than those in the control group who averaged 2.75 points of growth. These data are shown in the Table 19.

Qualitative Findings

Two video cameras were used during the intervention sessions. One camera was placed on a tripod and angled to view the entire group of participants. A second handheld camera was used to get closer shots, and to record conversations among and with participants. Headphones were used by participants in the intervention depending on the status of the computer's sound jack, and the working condition of each participant's set of headphones. Fortunately, the game's instructions could be readily derived from reading the in-game prompts as well as through listening to the instructions through the headphones.

Experience sampling methodology (Zirkel, Garcia, & Murphy, 2015) or ESM surveys were administered during the intervention periods when the researcher witnessed a behavior or a series of behaviors that were worth documenting. Five ESM surveys were administered per thirty-minute session. At the end of each intervention period, two participants were chosen from the five who completed an ESM survey that day to give their impressions about that day's intervention session during a short-videotaped interview session. These short interview sessions lasted between three to five minutes. The researcher used the ESM survey questions from that day as a starting point for each interview, and asked follow up questions based on their responses.

Table 19

Reading 3D Dibels DAZE Data Comparison for Second Eight Weeks

	Group A Control - 8 weeks	Group A Control - end	Difference	Group B Intervention - 8 weeks	Group B Intervention - end	Difference
Dibels DAZE Overall	7.61	10.53	2.92	5.45	8.72	3.27
Dibels DAZE Gender - Female	7.77	10.77	3	5.75	9.12	3.37
Dibels DAZE Gender - Male	7.25	10	2.75	4.66	7.66	3
Dibels DAZE Ethnicity - African-American	6.57	9.28	2.71	3.83	6.66	-2.83
Dibels DAZE Ethnicity - Caucasian	14.5	18.5	4	6.5	8.5	2
Dibels DAZE Ethnicity - Hispanic	6	8.75	2.75	8	13	5

The video footage was coded according to the date of the experiment and the chronological order of the shots. For example, video shots on September 29th were coded as 9-29-1, 9-29-2, and so on. The files were downloaded with a card reader onto a laptop computer, and then copied onto a portable hard drive as a back up. Then, the files were transferred from the portable hard drive onto the desktop computer on which the NVivo (Version 10) program was installed. From that point, the files were loaded into the NVivo project file, and coded according to the six elements of flow as described in the Fang, Zhang, and Chan (2013) study.

Participants

The participants were split into two groups (Group A and Group B), an intervention group and a control group. These groups alternated roles after eight weeks of intervention. Group A served as the intervention group during the first eight-week intervention period and, as the control group during the second eight-week intervention period. Group A had a total of thirteen students who participated in the study. All of these participants submitted a parent consent form, answered in the affirmative to the student assent statement, and were enrolled in the target school during the entire sixteen-week intervention period. The gender totals were nine girls and four boys. In terms of ethnicity, Group A seven African-Americans, two Caucasians, and four Hispanic students.

Group B served has the control group during the first eight-week intervention period, and the intervention group during the second eight-week intervention period. Group B had a total of eleven students who participated in the study. All of these participants submitted a parent consent form, answered in the affirmative to the student assent statement, and were enrolled in the target school during the entire sixteen-week intervention period. The gender totals were

eight girls and three boys. In terms of ethnicity, Group B had six African-Americans, two Caucasians, and three Hispanic students.

Qualitative ESM Coding Results

While participating in their respective intervention period, each group's video was coded using the NVivo program according to six elements of flow as conceptualized by Fang et al. (2013). The foundational definitions for each element of flow are drawn from the work of Csikszentmihalyi (1993), and are described in Table 20.

Over the course of the sixteen-week study, twelve hundred and eighty-one events were coded according to the six elements of flow during the intervention sessions, while four hundred and thirty-four were coded during the post intervention interviews. The months of October and January had the highest number of events coded. These months also had the greatest number of intervention days (eight each). The months of November and December, which had six days of intervention, had the least number of coding events. The flow elements of immersion, concentration on the task at hand, and a challenging activity that requires skill were coded the most during the study, while the elements of autotelic experience and paradox of control had the lowest amount of coding events. Table 21 describes the coding totals according to each month of the study.

Four hundred and thirty-four moments were coded during the post-intervention session interviews. The monthly amounts of coding were fairly even except for the month of January. The month of September and November yielded the highest amount of interview coding. The flow elements of challenging activity that requires skill and clear goals and feedback were coded the most during the interviews eighty-nine responses each. The flow elements of concentration

Table 20

Descriptions for the Elements of Flow

Elements of Flow	Description
Autotelic Experience	The activity becomes totally engrossing and intrinsically rewarding.
A Challenging Activity that Requires Skill	The activity requires a certain level of mental energy in order to complete the task.
Clear Goals and Feedback	The objectives are clearly defined and the participant instantly knows how well they are doing.
Concentration on the Task at Hand	Irrelevant information is filtered out during the experience.
Immersion	Participants become so involved in the activity that they loses track of elapsed time and becomes a part of the activity to the point where they are no longer separate themselves from their actions during the experience.
Paradox of Control	Participants feel in control of their actions and are able to freely navigate within the activity's environment.

Table 21

ESM Coding Results During Intervention Sessions

Sessions	September	October	November	December	January	Coding Totals During Sessions
Immersion	47	89	49	37	54	276
Concentration on the Task	29	86	39	38	66	258
Challenging Activity	27	84	35	43	52	241
Autotelic Experience	28	68	15	20	46	177
Paradox of Control	37	71	30	21	30	189
Clear Goals & Feedback	33	45	26	12	24	140
Monthly Sessions Totals	201	443	194	171	272	1,281

on the task at hand and the paradox of control were the least coded with thirty-nine and fifty-six responses, respectively. These totals are displayed in Table 22.

Table 23 lists how many events were coded during the thirty-minute intervention sessions during each eight-week intervention. Across the flow elements, more incidents were coded during the first eight-week session (806), than during the second eight-week session (475). The difference in the amount of events coded might be attributed to the researcher's increased understanding (over the duration of the study) of what events were worthy of coding as opposed to coding any peculiarity in behavior, which may have occurred toward the beginning of the study. The researcher also revisited the flow elements on a periodic basis in order to continually refine which elements of flow should be coded.

A listing of how many events were coded during the intervention interviews during each eight-week intervention is provided in Table 24. These coding patterns were similar to the intervention sessions, where more incidents were coded during the first eight-week session than the second eight-week session for each flow element, with the exception of concentration on the task at hand.

Qualitative Results - First Eight Weeks (non-ESM)

The first intervention began with the challenge of overcoming technical issues with the student logins. It became immediately apparent that many of the students didn't know their assigned username and password. Fortunately, the classroom teacher prepared a notebook with the login information for each student. There were also difficulties with the student's headphones. Specifically, the headphones malfunctioned or the computer sound jack didn't work. Fortunately, the game's instructions and prompts could be read and understood without the need for sound. On the first day of intervention, five of the students reported issues with

Table 22

ESM Coding Results During Post- Intervention Session Interviews

Interviews	September	October	November	December	January	Node Totals During Interviews
Immersion	18	13	14	19	14	78
Concentration on the Task	0	6	11	7	15	39
Challenging Activity	23	26	16	14	10	89
Autotelic Experience	18	13	22	22	8	83
Paradox of Control	18	14	12	4	8	56
Clear Goals & Feedback	18	16	17	22	16	89
Monthly Interview Totals	95	88	92	88	71	434

Table 23

Session Coding Totals by Eight-Week Period

Element	First Eight-Week Session	Second Eight-Week Session
Immersion	179	97
Concentration on the Task	148	110
Challenging Activity	142	99
Autotelic Experience	111	66
Paradox of Control	127	62
Clear Goals & Feedback	99	41
Totals	806	475

Table 24

Interview Coding Totals by Eight-Week Period

Element	First Eight-Week Session	Second Eight-Week Session
Immersion	42	36
Concentration on the Task	17	22
Challenging Activity	62	27
Autotelic Experience	46	37
Paradox of Control	37	19
Clear Goals & Feedback	47	42
Totals	251	183

faulty headphones or headphone jacks. The LEA's technology director had expressed concerns about the program's security so he insisted that I had to sign in on every computer after every student logged in so that they can access the game. Technical issues aside, the student's enthusiasm for the game was immediately apparent.

Some students were focused on the task of completing puzzles to progress throughout the game. A few others decided to make random objects like cars, tractors, and trains. These objects tended to be based on personal preference and experiences. One student marveled at the ability to make a pig fly and create a car for no apparent reason. Most students reported that the game was relatively easy to master. For example, I witnessed the use of "starite vision" -- a feature that focuses on in-game characters or objects that trigger starite puzzles -- on a few occasions in the first two weeks of both the first and second intervention phases. However, some students had a little difficulty with using the keyboard to spell words to make objects. Specifically, an in-game keyboard appeared with several symbols when the students used their notebook to create an object. The students attempted to use this keyboard via the computer's mouse. However, the correct way to input alphabetic letters into the game was to use the computer's physical keyboard. The students were able to make the correction with minimal instruction.

Paradox of Control

The participant responses in the flow element of paradox of control displayed a direct correlation to their comfort level with game's controls. Table 25 depicts Group A's responses to the paradox of control questions during their eight weeks of intervention. The participant's responses in this element show an increase for the second paradox of control question during the

Table 25

Group A Overall Responses to the Paradox of Control Element

Group A Overall	Paradox of Control Question 1	Paradox of Control Question 2
Sept.	5.4	4.8
1st Half of Oct.	5.8	5.2
2nd Half of Oct.	4.6	5.2
Nov.	5.2	7

entire length of the intervention, which peaked at the maximum of seven during the group's last month of intervention.

The student login process improved with each successive intervention session. As a matter of fact, most of the students logged in and were eagerly awaiting my login after a couple of sessions. After a few interventions sessions, I started to witness collaboration among students. Specifically, students who experienced difficulty with solving puzzles or spelling words began to ask their peers for assistance. I must admit that I struggled with this when it first occurred. The concept of relinquishing control of this experience to the students was frightening at first. I wanted them to solve the puzzles instead of talking to their neighbors. However, I quickly began to see that the peer communication seemed to shorten their learning curve. They solved puzzles faster and discussed alternative ways to solve them. For example, one student made an airplane, flew it around the level, and eagerly shared how to do this in order to solve a puzzle. By the month of October, I noted that the partnerships were becoming more purposeful.

The reactions to administering the surveys were mixed. The participants were provided with a pre-sharpened pencil and reminded of the instructions on how to compete the survey. The instructions were to write their name at the top of the page, and then to circle the numbered response that best described their response to each question. The students had to be reminded on a couple of occasions to complete the surveys because they were engrossed in gameplay.

Concentration of the Task at Hand

Toward the beginning of the intervention, the girls seemed to be more focused on the objective. They progressed through the game's levels at a faster rate. On the other hand, the boys were making random things, mostly vehicles, and exploring so see if they worked in the game. One student even asked, "Can I do whatever I want in the game?" Another boy student

Table 26

Group A Female and Male Responses to the Concentration on the Task at Hand Element

Group A - Female	Concentration Question 1	Concentration Question 2	Group A - Male	Concentration Question 1	Concentration Question 2
Sept.	5.5	6.6	Sept.	5	1
1st Half of Oct.	4.6	6.5	1st Half of Oct.	4	5.6
2nd Half of Oct.	7	7	2nd Half of Oct.	4.5	7
Nov.	5.25	7	Nov.	6	6.5

made a dodo bird for no apparent reason other than just wanting to see one. Table 26 shows Group A's female and male responses to the element of concentration on the task at hand. With the exception of one question, the female participants averaged higher responses than the male for each question during the intervention. During September, the first month of intervention, the females averaged 0.5 more points for the first question and 6.5 points for the second question. During the first half of October, the females averaged 0.6 more points for the first question and 1 point for the second question. During the second half of October, the females averaged 2.5 points more for the first question and the second question yielded equal results. For the last period of intervention, the males averaged 0.75 more points on the first question, while the females averaged 0.5 more points on the second question.

Despite experiencing some game crashes upon login, the participants progressed steadily through the game levels. Small partnerships started to form in order to provide assistance with solving puzzles or sharing objects they created in the objects editor. I noted that two students with comparatively higher beginning of year TRC reading levels progressed more quickly through the game's levels. Yet, all students quickly began to ask for became to be known as spelling assistance. Spelling assistance usually happened when a student knew what they wanted to create but did not know how to spell the word.

After the first two weeks of intervention, the student partnerships started to produce some questions pertaining to gameplay. To wit, students were frequently asking each other how to spell words and how to approach problem solving. There was a joyful atmosphere in the computer lab and students were having fun with helping each other with the puzzles. The puzzles posed an interesting variety of questions ranging from how to assemble parts such has batteries, motors, armor, and guns to create a battle robot to creating the components of a

romantic date such as tuxedos, dresses, music, and candlelight. Other puzzles challenged students to list the ingredients to various food items like pizza. These challenges often forced students to find new and different to solve a puzzle after a short period of frustration. For example, when several students encountered a level that required them to help a bed ridden character. Some immediately spelled the word medicine in order to solve the puzzle, while others struggled with this spelling so some of them created a healer. This solution also solved the puzzle.

Challenging Activity that Requires Skill

Table 27 displays Group A's responses to the challenging activity that requires skill. The responses for the first question ranged between 5.4 and 5.8 (out of 7) with a dip of 4.6 in the second half of October. The second question responses stayed within a similar range of 5.4 to 5.8 with a spike of 7 in the first half of October. The responses to the third question ranged form 5.8 to 6.4 with a spike of 7 in the second half of October, and the responses to the fourth question yielded a lower range of 4.4 to 5 with a high of 6.6 in the month of November.

One participant moved to another seat because of a faulty computer during the third session of Group A's intervention. She lost some of her saved game data but showed a lot of resilience by joining another "team." They immediately helped her to redo the initial stages. However, the teams have had another byproduct: competition. For example, some participants have expressed frustration when they didn't solve a puzzle as quickly as their peers or didn't receive enough assistance from peers. In particular, one student expressed frustration with a puzzle but was able to conquer it with a little help. This was highlighted in the October 6, 2014 interview. The partnerships continually evolved, depending on student attendance.

Table 27

Group A Overall Responses to the Concentration on the Task at Hand Element

Group A - Overall	Challenging Activity Question 1	Challenging Activity Question 2	Challenging Activity Question 3	Challenging Activity Question 4
Sept.	5.8	5.4	6.4	5
1st Half of Oct.	5.4	7	5.8	5
2nd Half of Oct.	4.6	5.8	7	4.4
Nov.	5.4	5.6	5.8	6.6

By the third or fourth session of the first intervention group, the participants were progressing well through the game's levels. There were about three to four students in a group who are moving faster than the others. However, since the students sit closely together, I'm fairly certain that their mutual progress was a result of collaboration. A good surprise…the participants all expressed disappointment when the end of the sessions were announced.

By the middle of October, the participants were well versed in the setup procedures. They even handled computer crashes with aplomb. The mood of the group was also noticeably more joyful. There are more collaborative conversations that apply to spelling words and problem solving. The number of times that participants sought spelling assistance began to grow during this time. Also, when faced with a more difficult challenge, participants sought help from each other instead of referring to game based cues.

There seems to be a tipping point of interaction after the students are logged into the game. Before logins are completed, the participants were more subdued and quiet. Afterward, the volume of voices, classroom discussion, and student interaction all increased. Students exhibited joyous reactions to discoveries and in-game accomplishments. Today, I recorded participants talking about what they did and even videoed a couple of celebrations. The participants repeatedly celebrated the acquisition of starites and conquering in-game obstacles. There were several high-fives and much laughter.

Autotelic Response

Table 28 displays the Group A's averaged responses to the autotelic response questions. The responses stayed within the 5.8 to 6.2 ranges for the month of September. However, the first two weeks of October saw an increase to the maximum of 7 for the last two autotelic response questions. The last two weeks of October averaged within 0.2 points for the duration of the

Table 28

Group A Overall Responses to the Autotelic Response Element

Group A - Overall	Autotelic Question 1	Autotelic Question 2	Autotelic Question 3
Sept.	6.2	6	5.8
1st Half of Oct.	4.8	7	7
2nd Half of Oct.	5.8	5.8	5.6
Nov.	5.8	6	6.8

intervention. November saw an increase for the questions two and three from the last half of October through November.

By the beginning of November, the sharing of ideas began to break the bonds of the previously formed groups. Participants started to walk across the room to ask for assistance, observe the play of others, and to celebrate their accomplishments. In one post intervention interview, one student shared that he didn't want to finish the levels and that he liked to stay behind the pace of others so he could learn from his peers.

The participants' pace began to slow down when they encountered more difficult game levels. Some of these levels required comprehension of words such as "cranial" and "suitable." However, the participants were able to think of a proper solution with little prompting (or just restating the puzzle into the form of a question). But spelling became the biggest limitation to solving the puzzles. For example, one student was working a puzzle that required the player to sever a rope in order to save an in-game character from drowning. The student understood what item was needed to complete the task but encountered difficulty with spelling the word "scissors."

Collaboration and student excitement also continued to increase. This change in behavior seemed to coincide with the students having more discussions and celebrations about their increased proficiency during the game. The participants also collected items in their virtual backpacks, and they continually asked each other to spell more and more complex words. In terms of tasks, the participants fixed cars (with mechanics), hunted for food (with the help of hunters/trackers), and created bands and instruments to put on concerts.

Heading into the last week of intervention for Group A, I found that some participants made considerable progress through the game (eight to ten levels) while others only made it

through three or four levels. I have also found that collaboration was more of a necessity for the participants since most of them have progressed to more difficult game maps. For example, when one student's usual partner didn't show up, she asked another student to sit beside her "because she didn't want to play alone."

During the post-session interviews, the participants continually expressed that they thought the game's control systems and concept were easy to grasp. They also were aware of how well they progressed by the number of starites they collected. However, some expressed difficulty with figuring out some puzzles. For example, several students had a hard time figuring out how to ward off a swarm of cockroaches in one level. One student mentioned that she made a can of super bug spray to solve the problem. Another student made a bazooka to kill the cockroaches.

Qualitative Results - Second Eight Weeks (non-ESM)

The login and tutorial process went much more smoothly for Group B than the initial group. The student headphone issue was not as prevalent with this group. Only three students reported problems with their headphones during the few first weeks of this second phase of the study. While a lot of energy was spent of learning the basic controls of the game, the participants of Group B also seemed to pick up the control system more quickly. Group B also seemed to be more subdued in terms of class volume and interaction. However, the participants were already starting to work their way through the levels in the first week of intervention. In fact, one student completed their third level on only the second day of game play.

Some students asked clarifying questions when the surveys were administered the first few times. Others flew through the questions in order to resume playing as soon as possible. Again, the participants were provided with a pre-sharpened pencil and reminded of the

instructions on how to compete the survey. Like Group A, the students had to be reminded on a couple of occasions to complete the surveys because they were engrossed in gameplay.

During the second week of intervention, the participants appeared to have mastered the control system. However, the participants had mixed results with solving the puzzles. For example, one participant wanted to "check out" after encountering difficulty with solving a puzzle. So, I attempted to alleviate that frustration by reminding him of the importance of just trying to answer the question. Another student tried to answer a question with a phrase instead of an object, and this was easily corrected. On the other hand, I also witnessed some innovative solutions from this group. For example, one participant chose to save a stranded cat from a tree with a jet pack instead of using a ladder like most students. Another student attached wings to an underwater monster in order to have creative transportation.

Paradox of Control

Table 29 displays Group B's averaged results for the two questions under the paradox of control element. Group B's September averages 7 and 6.2 were higher in each question as compared to Group A's averages of 5.4 and 4.8. The same trend continues for the first two weeks of October where Group B's averages of 5.8 for question one and 6.2 for question two equaled Group A's 5.8 average for question one and scored higher than Group's average of 5.2.

Toward the beginning of December, the participants seemed to understand the importance of reading context clues in the game's questions/puzzles to be more successful. For example, students were able to answer questions like, "What makes a sound on a fire truck," or "Whom do you take a broken car to for repair?" This group was more excitable and the level of collaborative celebration increased, especially when new levels were opened or new objects were created.

Table 29

Group B Overall Responses to the Paradox of Control Element

Group B - Overall	Paradox of Control Question 1	Paradox of Control Question 2
Nov.	7	6.2
Dec.	5.8	6.2
1st Half of Jan.	7	6.4
2nd Half of Jan.	7	6.4

After sometime of just spelling words for students upon request, I decided to ask them to take the time to say each phonetic sound before assisting them immediately. The reactions were mixed. Some immediately started to sound out words while others seemed irritated at the delay this caused. I also started to encourage them to read the sentences and only providing synonyms/definitions when they reached an unfamiliar word. Certain puzzles contained words like “mobility” and “cranial,” and this led to discussions about the definition and context of words.

The students started to use facets of the game in imaginative ways. For example, they began to use the image editor to modify their avatar. Some were very excited about creating costumes for their avatars, while other gave their avatars flying abilities. One student even combined these attributes by making his avatar into a flying banana. In the middle of January, the participants departed from creating flying characters and made attempts to personalize their avatars. Several students held impromptu help sessions in the object editor to accomplish this. Some made smaller or giant versions of themselves while others made characters with disproportionate bodies. One student decided to make a girlfriend character. These behaviors were unique to Group B. This group seems to be more creative and tended to explore worlds instead of racing to complete the game’s levels. Several comments were made by some of the boys about freezing things and setting things on fire.

Immersion

Group A averaged higher responses for questions two and three where they averaged 0.95 more points for question two, and 0.95 points for question three. These practices are reflected in Table 30. Group B’s scores in the element of immersion averaged higher responses than their counterparts on four out the six questions posed during the survey. Group B averaged 6.25

Table 30

Group A Overall Responses to the Immersion Element

Group A -Overall	Immersion Question1	Immersion Question 2	Immersion Question 3	Immersion Question 4	Immersion Question 5	Immersion Question 6
Sept.	4.6	5	5	6.6	4.6	3.2
Oct.	4.6	6	5	6.4	5.8	4.2
Oct.	5.4	5.6	5.2	7	5	5.8
Nov.	4.6	7	5.8	5.8	5.2	5.2
Avg.	4.8	5.9	5.25	6.45	5.15	4.6

points for the first question compared the Group A' 4.8 average. The trend continued for Group B for questions four, five, and six where they averaged 0.1 more points for question four, 0.6 more points for question five, and 0.95 more points for question six. These data are displayed in Table 31.

ESM Comprehensive Survey Results

The first comprehensive intervention survey was administered to Group A, then the intervention group, on November 18, 2014. Group B, the second group, received the survey on January 28, 2015. This data were calculated by averaging the questions in each element of flow. The averaged overall data can be found in the table 32. In this experiment, the student responses for the four questions that addressed the challenging activity that requires skill element, the six questions that addressed clear goals and feedback, the two questions that addresses the element of concentration on the task at hand, the two questions that addressed the paradox of control, the six questions that addressed the element of immersion, and the three questions that addressed the element of autotelic response were averaged. The responses for each group were averaged according to the elements of flow and arranged into the categories of overall, female, male, African-American, Caucasian, and Hispanic.

The overall data for the two groups were within one point of each other throughout the elements. These data are shown in Table 31. The challenging activity that requires skills element yielded a 0.27 difference in favor of Group B. Group A displayed higher answers in the clear goals and feedback element with a 0.12 point difference. The elements of concentration the task at hand and the paradox of control also yielded higher responses from Group A with a 0.33 difference in first element and a 0.16 difference in the second. However, the elements of

Table 31

Group B Overall Responses to the Immersion Element

Group B - Overall	Immersion Question 1	Immersion Question 2	Immersion Question 3	Immersion Question 4	Immersion Question 5	Immersion Question 6
Nov.	7	3.6	4.8	6.4	5.4	5.8
Dec.	7	4.8	4.4	7	5.8	5.2
Jan.	5.8	5	3.4	5.8	6.2	5.8
Jan.	5.2	6.4	4.6	7	5.6	5.4
Avg.	6.25	4.95	4.3	6.55	5.75	5.55

Table 32

Group A and B Overall Averaged Responses for the Comprehensive Survey

Group A Overall	Averaged Responses	Group B Overall	Averaged Responses
Challenging Activity	5.57	Challenging Activity	5.84
Clear Goals & Feedback	6.02	Clear Goals & Feedback	5.9
Concentration on the Task at Hand	5.96	Concentration on the Task at Hand	5.63
Paradox of Control	5.88	Paradox of Control	5.72
Immersion	5.14	Immersion	5.59
Autotelic Response	6.28	Autotelic Response	6.57

immersion and autotelic response averaged higher for Group B with a 0.45 difference in immersion and a 0.29-point difference in autotelic response.

The female students in Group B provided higher results in every element except concentration on the task at hand and paradox of control, where Group A averaged 0.06 more points in the first element, and a 0.32 higher average in the latter element. Group B averaged 0.78 more points in the challenging activity that requires skills element, and a 0.29 point increase in the element of clear goals and feedback. Group B also averaged 0.64 more points in the immersion element, and a 0.04-point increase in the element of autotelic response. The averaged female data can be found in the Table 33.

Table 34 shows that the averaged results of the male students were split where Group A averaged higher results in the challenging activity that requires skills element (0.7 point increase), the clear goals and feedback element (1.04 point increase), and the concentration on the task at hand element (0.32 point increase). On the other hand, Group B averaged higher results in the paradox of control element (0.13 point increase), immersion element (0.3 point increase), and the autotelic response element (0.87 point increase).

The African-American students in Group A provided higher results in every element except clear goals and feedback and autotelic response, where Group B averaged 0.1 more points in the first element, and a 0.05 higher average in the latter element. Group A averaged 0.05 more points in the challenging activity that requires skills element, and a 0.38 point increase in the element of concentration on the task at hand. Group A also averaged 1.23 more points in the immersion element, and a 0.45-point increase in the element of paradox of control. The averaged data for African-American participants can be found in the Table 35.

Table 33

Group A and B Female Averaged Responses for the Comprehensive Survey

Group A Female	Averaged Responses	Group B Female	Averaged Responses
Challenging Activity	5.18	Challenging Activity	5.96
Clear Goals & Feedback	5.87	Clear Goals & Feedback	6.16
Concentration on the Task at Hand	5.93	Concentration on the Task at Hand	5.87
Paradox of Control	6	Paradox of Control	5.68
Immersion	4.79	Immersion	5.43

Table 34

Group A and B Male Averaged Responses for the Comprehensive Survey

Group A Male	Averaged Responses	Group B Male	Averaged Responses
Challenging Activity	6.2	Challenging Activity	5.5
Clear Goals & Feedback	6.26	Clear Goals & Feedback	5.22
Concentration on the Task at Hand	6	Concentration on the Task at Hand	5.68
Paradox of Control	5.7	Paradox of Control	5.83
Immersion	5.7	Immersion	6

Table 35

Group A and B African-American Averaged Responses for the Comprehensive Survey

Group A African-American	Averaged Responses	Group B African-American	Averaged Responses
Challenging Activity	5.25	Challenging Activity	5.2
Clear Goals & Feedback	5.78	Clear Goals & Feedback	5.88
Concentration on the Task at Hand	5.71	Concentration on the Task at Hand	5.33
Paradox of Control	5.78	Paradox of Control	5.33
Immersion	6.28	Immersion	5.05

The Caucasian students in Group A provided higher results in every element except immersion and autotelic response, where Group B averaged 1.34 more points in the first element, and a 0.72 higher average in the latter element. The averaged data for Caucasian participants canbe found in the Table 35. Both groups yielded the same average (6.25 points) in the challenging activity that requires skills element, while Group A averaged 1.42 more points in the element of clear goals and feedback. Group A also averaged 1.0 more point in the concentration of the task at hand element, and a 0.75-point increase in the element of paradox of control. The averaged data for Caucasian participants can be found in the Table 36.

The Hispanic students in Group B average higher responses in every element except immersion, where Group B averaged 0.15 more points. Group A averaged 0.77 more points in the challenging activity that requires skills element, and a 0.17 point increase in the element of clear goals and feedback. Group A also averaged 0.21 more points in the element of concentration on the task at hand, a 0.71 point increase in the element of paradox of control, and a 0.49-point increase in the element of autotelic response. The averaged data for Hispanic participants can be found in the Table 37.

ESM Emotion Based Data

Five emotion-based questions were asked at the end of each of four ESM surveys (see Appendixes E, F, G, & H). Based on the work of Fang, Zhang, and Chan (2013), these questions were designed to gauge the participant's emotions along the following ranges. They were (a) felt sad to happy, (b) bored to eager, (c) upset to calm, (d) ashamed to pleased, and (e) mad to glad. A seven-point Likert scale, where "1" will be labeled "low," "4" was labeled "undecided," and "7" was labeled "high," was utilized to record student responses. Students had the option to choose the intermediate data points (2, 3, 5, and 6) to indicate degrees of opinion.

Table 36

Group A and B Caucasian Averaged Responses for the Comprehensive Survey

Group A Caucasian	Averaged Responses	Group B Caucasian	Averaged Responses
Challenging Activity	6.25	Challenging Activity	6.25
Clear Goals & Feedback	6.5	Clear Goals & Feedback	5.08
Concentration on the Task at Hand	6.5	Concentration on the Task at Hand	5.5
Paradox of Control	6.75	Paradox of Control	6
Immersion	5.66	Immersion	7

Table 37

Group A and B Hispanic Averaged Responses for the Comprehensive Survey

Group A Hispanic	Averaged Responses	Group B Hispanic	Averaged Responses
Challenging Activity	6.06	Challenging Activity	6.83
Clear Goals & Feedback	6.33	Clear Goals & Feedback	6.5
Concentration on the Task at Hand	6.12	Concentration on the Task at Hand	6.33
Paradox of Control	5.62	Paradox of Control	6.33
Immersion	5.87	Immersion	5.72

Sad-Happy

In the overall classification, Group B averaged more responses toward the "happy" side of the scale throughout the course of the study than their counterparts in Group A. When comparing the responses for each of the four surveys, Group B either matched Group A or scored 2.4 points higher than Group B. Group B's scores also averaged a rating of seven on surveys C and D during the month of November compared the Group A's responses of 6.2 to 4.6 on the same surveys.

The female participants from Group B also averaged more responses toward the "happy" side of the scale than the participants in Group A. While both groups scored within 1.4 points of each other during the study's start, the responses for Group B had highest gaps compared to Group A in the middle of the survey. Interestingly, Group A's responses for Survey D dipped to lowest measure of one point towards the end of October, and averaged 3 points on Survey C toward the end of their intervention time. However, based upon my observations, the researcher cannot verify whether their responses were attributable to their gaming experience or extraneous factors.

Group A's male participants averaged higher responses than Group B. However, no males from Group B responded to Surveys A, B, and C during the first two weeks of their intervention. Also, no males from Group B responded to Surveys A and B in the first two weeks of January. Interesting, the boys from Group A averaged the maximum of seven for Survey D throughout the entire study and the boys all seemed very excited and engaged during these intervention sessions.

Group B's African-American students averaged more responses toward the "happy" category except for the first two weeks of October. The highest gap between groups happened at

the start of the intervention. Also, Group A's results from Survey D averaged a score of three points during the same time period. On the other hand, Group B averaged the maximum responses of seven for Surveys C and D during the initial stages of their intervention.

The data for Group A and Group B's Caucasian students averaged comparatively high responses of seven points for all surveys expect for a score of six (Group A) on Survey D during the last two weeks of their intervention period. Based on my observations, these students seemed to be upbeat and contented during the intervention sessions.

While no Hispanic students in Group A responded to this question for Survey D at the start of the intervention, or for Survey C at the end of the intervention, the data for the Group A's Hispanic students averaged "happier" responses than Group B. Like the Caucasian students, Groups A's Hispanic data averaged in the six to seven point range with a dip to 3.5 on Survey B in the first two weeks of September.

Bored-Eager

Group B marked more responses toward the "eager" category than their counterparts in Group A throughout the length of the study. The largest gap occurred during the third and fourth weeks of their respective intervention periods. Interestingly, Group A averaged the minimum response of one on Survey D during the last two weeks of October.

Groups B's female participants averaged more "eager" responses during the entire study. The highest gaps in responses occurred during the two weeks of October for Group A, and the first two weeks of January for Group B. Also, the data for Group A's for Survey D averaged more "bored" scores of 1, 4.75, and 5 up until the last two weeks of the intervention.

The male participants of Group B responded with the maximum response of seven points during the entire study. These data corroborate the researcher's observations of being

continually asked about various aspects of Scribblenauts Unlimited, namely the ability to modify the costumes and abilities of their avatars.

Group B's African-American demographic also averaged more responses towards the "eager" category with the largest gap occurring the first two weeks of October for Group A, and Group B's two weeks of intervention in December. Group B's data also had the more "eager" averages for Surveys A and D. The Caucasian participants of Group B followed the same trend as their African-American peers. In fact, Group B's Caucasian students all indicated the maximum average of seven for all surveys administered.

In a departure of the last data measures, Group A's Hispanic student groups posted more "eager" responses for the entire study except for the first two weeks of September for Group A, and the first two weeks of November for Group B. All responses were within the six to seven point ranges except for Group A's dip to 3.5 on Survey B during the first two weeks of September.

Upset-Calm

In the overall classification, Group B circled more responses that corresponded to the "calm" emotion during the length of the study with the largest gaps in the last half of the study. Group B averaged the maximum response of seven on Survey D for the entire study.

In step with the overall data, Group B's female participants averaged more "calm" responses during the entire study. On Surveys A and D, Group B averaged the maximum responses of seven during all surveys except for one average of six on Survey A during the last two weeks of January. The male participants in Group B posted maximum responses of seven for all surveys administered, while Group A's responses averaged within the five to seven point ranges except for a drop to 3.5 in Survey B during September's intervention time. This may

reflect some anxiety with mastering the game's control system or solving puzzles during the beginning of the study.

In the race classification, the African-American, Caucasian, and Hispanic students of Group B posted more responses in the "calm" category than Group A for the entire study. Group B's African-American students posted the maximum response for Survey D for the entire study, and posted averages of seven for the administration of Survey A except for an average of six during the last two weeks of January. Like the previous section, Group B's Caucasian students all indicated the maximum average of seven for all surveys administered. The Hispanic students of Group B posted "calm" scores in the six to seven point ranges for all surveys administered. However, the lowest responses for these students were derived from Survey B. However, Group A' Hispanic participants averaged responses of seven for Survey A and B during the latter half of the study. This may indicate an increased comfort level with the characteristics of Scribblenauts Unlimited as the study began to wind down.

Ashamed-Pleased

In the overall classification, Group B's participants posted more "pleased" responses than their peers in Group A during the first half of their respective surveys. However, both averaged an equal amount of "pleased" responses during the last half of the intervention. The responses for both averaged within the five to seven point ranges except for dip of 4.4 for Group A in Survey B during the September intervention period.

The female participants of Group B averaged more "pleased" responses than Group A for most of the intervention period with a posting of seven scores in Survey A until the last two weeks of November. However, Group A posted more "pleased" responses in the last two weeks of November than Group B did in the last two weeks of January. Group B's male students all

indicated the maximum average of seven for all surveys administered while Group A's male students indicated the maximum average of seven for the first half of the study.

Like the female students of Group B, the African-American students also averaged more "pleased" responses during the study except for the first two weeks of November for Group A, and the last two-week of January for Group B. Once again, Group B's Caucasian students all indicated the maximum average of seven for all surveys administered. However, Group A's Caucasian student posted in the 6.5 to 7 point ranges except for a dip to an average score on one for Survey A during the last two weeks of November.

Group B's Hispanic students posted "pleased" scores in the six to seven point ranges throughout the study. However, the Hispanic students in Group A posted similar scores except for Survey B in the last two weeks of September which dipped to an average of 3.5 points.

Mad-Glad

According to the overall data, Group B posted the most "glad" responses during the length of the study with the largest gaps occurring during the first half of each respective intervention period. The female students in Group B also averaged more "glad" responses than their counterparts in Group A with the smallest gaps occurring during the last two weeks of November for Group A, and the last two weeks of January for Group B.

Group B's male students all indicated the maximum average of seven for all surveys administered while Group A's male students indicated seven scores during the study except for Surveys A and D during the first two weeks of September. This trend may indicate this section's growing confidence with playing Scribblenauts Unlimited as the study progressed.

Group B's African-American students posted more "glad" responses than Group A. However, Surveys B and C averaged a score a 5.5 for the last two weeks of January. Once

again, Group B's Caucasian students all indicated the maximum average of seven for all surveys administered. Group A's Caucasian students averaged scores in the six to seven point range except a point where Survey A dipped to an average of one during the first two weeks of November. The Hispanic students of Group B posted responses in the 6.5 to 7 point range except for a dip to 5 points on Survey D during the first two weeks of January. However, Group A's Hispanic students averaged scores of seven on Surveys A and D except for the first two weeks of September.

Summary

This chapter presented findings from this research study using both quantitative and qualitative data. The quantitative data were collected via three rounds of Reading 3D benchmark data. The data were analyzed as the component scores: Text and Reading Comprehension (TRC), Dibels Accuracy, Dibels Fluency, Dibels Retell and Dibels DAZE. The qualitative data was collected through the use of experience sampling method surveys (Hektner, Schmidt, & Csikszentmihalyi, 2007; Kubey, Larson & Csikszentmihalyi, 1996) during the intervention periods. The intervention periods were videotaped and coded in the NVivo program (Version 10) according the six elements of flow, in an approach that parallels that adopted by Fang, Zhang and Chan (2013).

Reading Comprehension and Fluency

Reading comprehension and fluency were measured by the Reading 3D Text Reading and Comprehension (TRC) and Dibels Fluency assessments. Based on the results from the first eight-weeks of the intervention, the quantitative data for Text Reading and Comprehension and Dibels Fluency revealed no statistically significant differences between the intervention group and control group, as indicated the fact that both groups displayed similar gains.

The quantitative data for the second eight-weeks of the intervention revealed that the intervention (Group B) group did show statistically significant growth in TRC for the second eight-weeks of intervention. However, both Group A and Group B participants' recorded statistically significant decreases in Dibels Fluency mean scores. Once again, it is important to note that a different assessor performed the MOY or end assessment (the third data point) that the person who facilitated the BOY and eight-week assessment (the first two data points). This change in testing protocol was mandated by the LEA's kindergarten through fifth grade curriculum director prior to the district-wide administration of the MOY assessment. In theory, this change should have made negligible difference because the scoring process for these reading assessments is standardized and empirically based, and all authorized scorers are trained to reliably implement the scoring rubric. The drastic differences in student outcomes as a result of the new assessor call into question the reliability of the Dibels scoring process.

Improvement and Expansion of Student Vocabulary

The Dibels Accuracy, Retell, and DAZE assessments measured the data differences in student vocabulary. Based on the results from the first eight-week intervention, the quantitative data for Dibels Fluency, Retell, and DAZE revealed no statistically significant differences between the intervention group and control group, as indicated by the fact that both groups posted similar gains. The quantitative data for the second eight-weeks of intervention revealed significant losses in Dibels Accuracy and Retell achievement. However, the students in the intervention group (Group B) recorded significant gains in the Dibels DAZE component.

Qualitative Data Summary

The elements of flow are described by Csikszentmihalyi (1993) contributing to the potential for an individual to reach a state pleasurable absorption in an activity, Csikszentmihalyi

referenced, among other examples, the pleasurable satisfaction a long-distance runner experiences in the act of running when he or she has "zoned in" and his or her body motions seem effortless (see Table 20).

During the first eight-weeks of intervention, the participant survey responses displayed an increase in the flow elements of "paradox of control," "concentration on the task at hand," "challenging activity that requires skill," "and autotelic response." The second "paradox of control" question, which contains the phrase "felt in control," revealed an upward trend during this part of the intervention. I believe this is attributable to the participant's growing knowledge of the game's control systems as the intervention went on. Figure 8 describes the group's responses in this element.

The "concentration on the task at hand" element highlighted an interesting gender comparison where the female participants averaged higher responses than their male counterparts during the first eight-weeks of the intervention. The female data are displayed in Figure 9, and the male data are displayed in Figure 10. These averages were mirrored by the researcher's observations that the female participants seemed to be more focused on obtaining "starites," the acquisition of which represent the game's main objective. The ESM survey data that addressed the element of "challenging activity that requires skill" displayed averages within the five to six point-range, with dips and spikes on a few questions in the month of October. These data reflected the researcher's observations of the participant's frustrations and celebrations that arose from spelling words and using those words to solve open-ended puzzles.

The element of "autotelic response," which references the participant's feelings of being rewarded and engaged, also averaged within the five to six point-range, with dips and rises in the

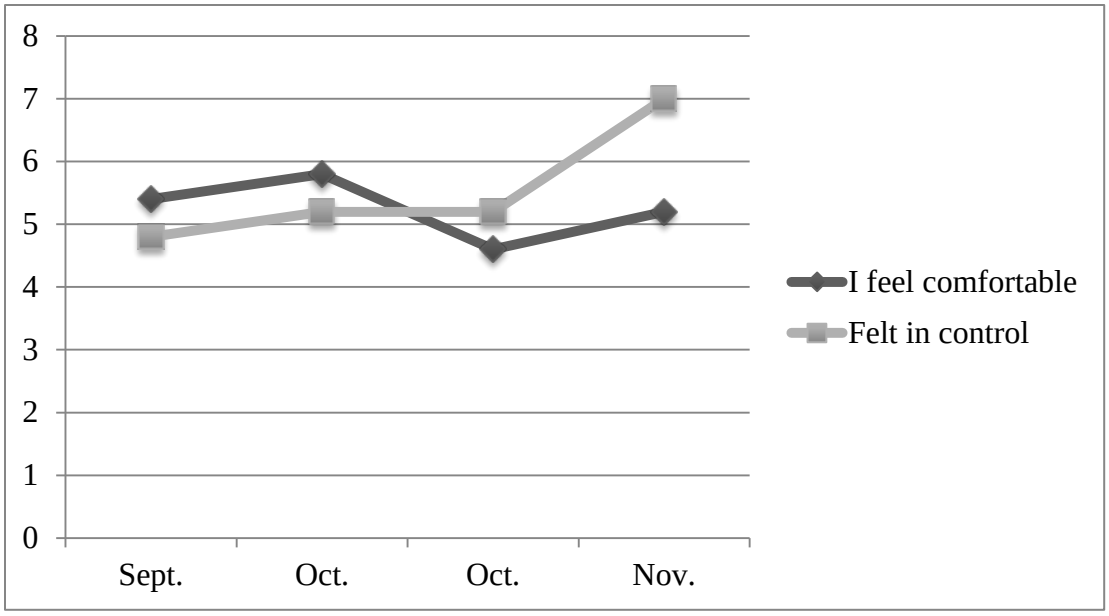


Figure 8. Line graph with plot points to display overall participant responses to the "paradox of control" ESM questions during the first eight-weeks of the intervention.

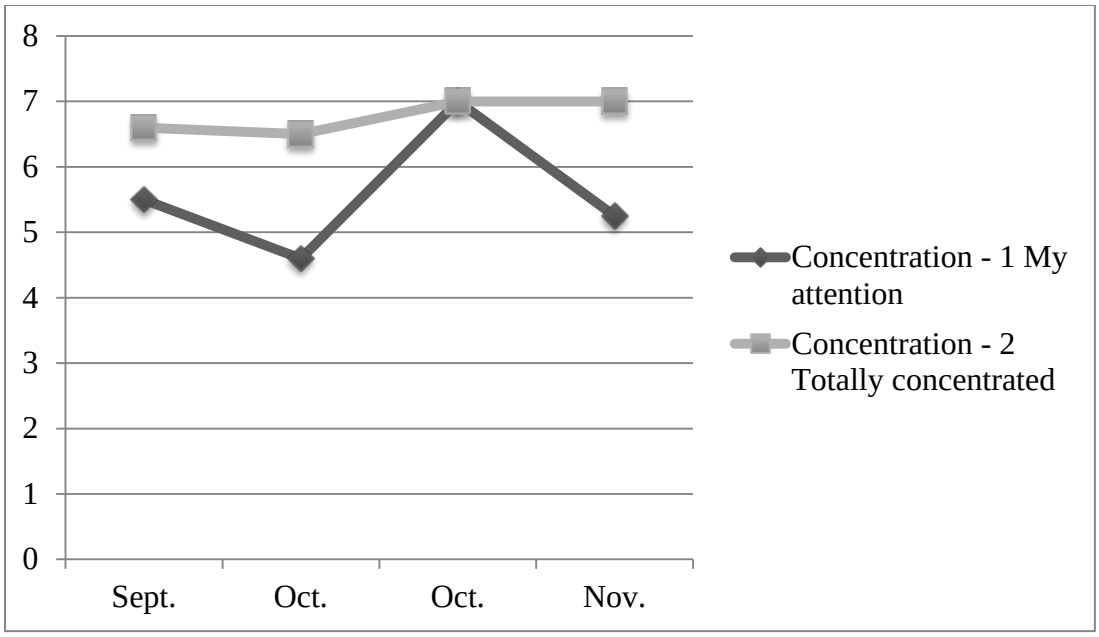


Figure 9. Line graph with plot points to display female participant responses to the "concentration on the task at hand" ESM questions during the first eight-weeks of the intervention.

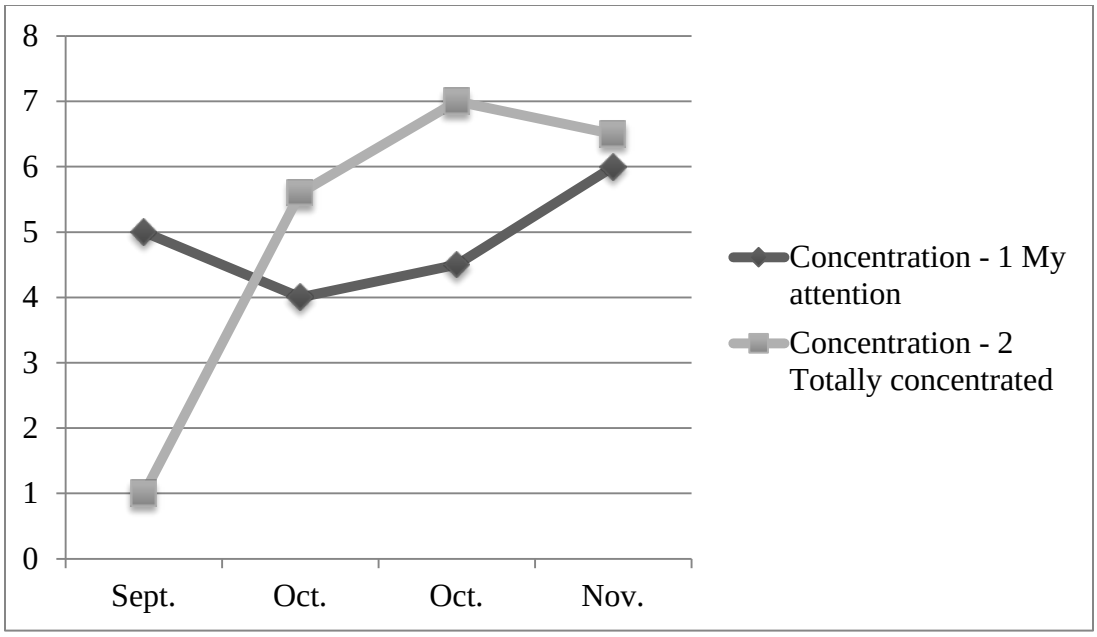


Figure 10. Line graph with plot points to display male participant responses to the "concentration on the task at hand" ESM questions during the first eight-weeks of the intervention.

month of October. These data, as displayed in Figure 11, closely mirrored the students' efforts as they employed collaborative approaches in order to move through the game's levels.

During the second eight-weeks of intervention, Group B's data for the element of "paradox of control" averaged higher than when Group A faced the intervention. These data reflected the researcher's observations that Group B had an easier time with mastering the game's control system. Group B's "paradox of control" responses are displayed in Figure 12.

The element of "immersion," which references the participants' perception of time and activity involvement, also yielded higher average responses for Group B on four out of the six "immersion" questions. Group A's responses to the "immersion" questions are displayed in Figure 13, and Group B's responses to the "immersion" questions are displayed in Figure 14.

The comprehensive ESM surveys revealed small differences in overall comparative scores for each element of flow between the two groups. The gender data revealed higher average results for Group B's female participants in four of the six elements of flow, while the male students of Group A averaged higher results in the flow elements of challenging activity that requires skill, clear goals and feedback, and concentration on the task at hand. Group B averaged higher scores in the remaining elements.

The ethnicity data revealed that Group A's African-American and Caucasian students averaged higher results in four of the six flow elements while the Hispanic students in Group A averaged higher results in five of the six elements of flow.

Summary of ESM Emotion Based Data

The emotion based questions on each survey designed to measure the participants' mood on the ranges of (a) felt "sad to happy," (b) "bored to eager," (c) "upset to calm," (d) "ashamed

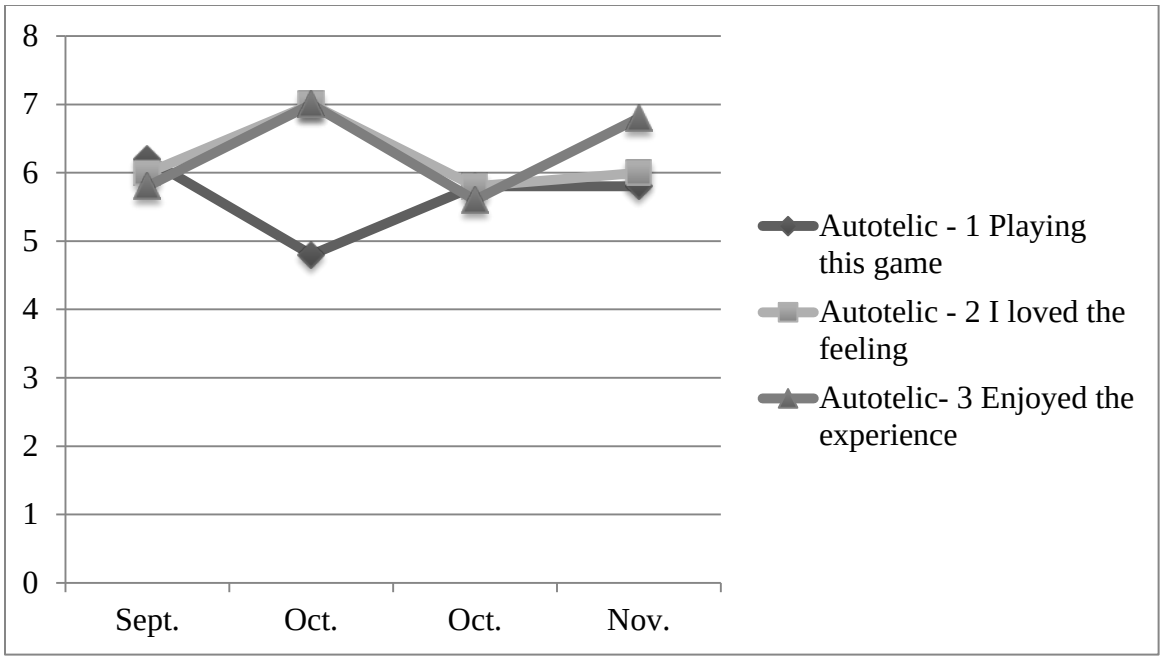


Figure 11. Line graph with plot points to display overall participant responses to the "autotelic response" ESM questions during the first eight-weeks of the intervention.

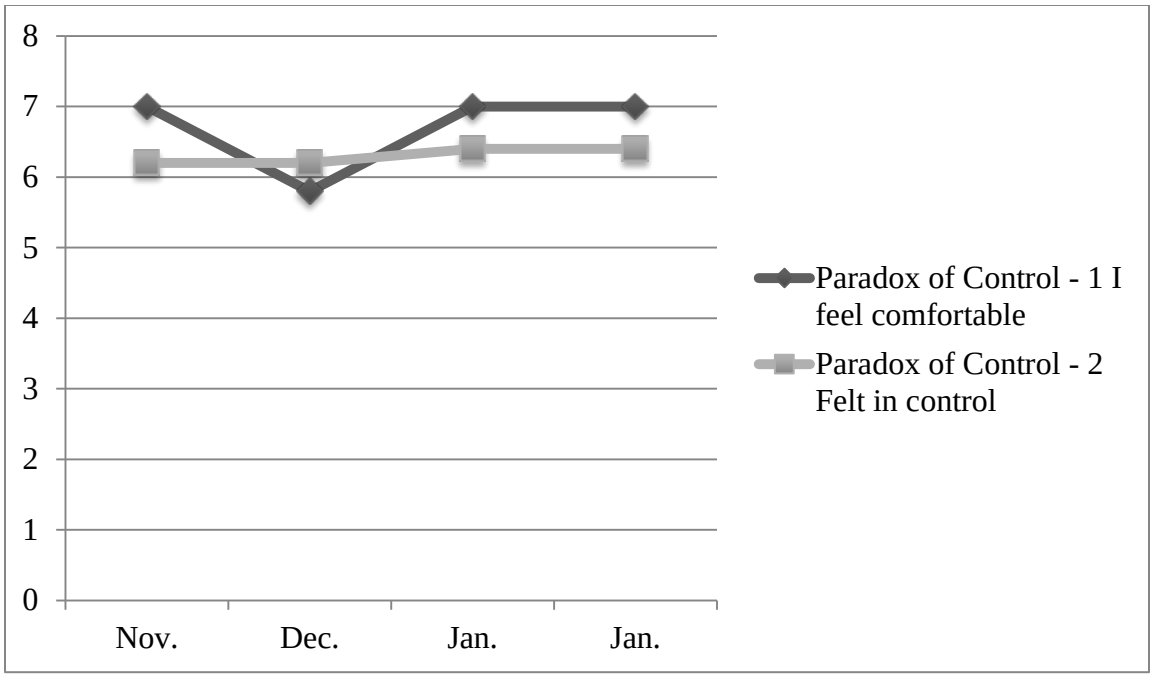


Figure 12. Line graph with plot points to display overall participant responses to the "paradox of control" ESM questions during the second eight-weeks of the intervention.

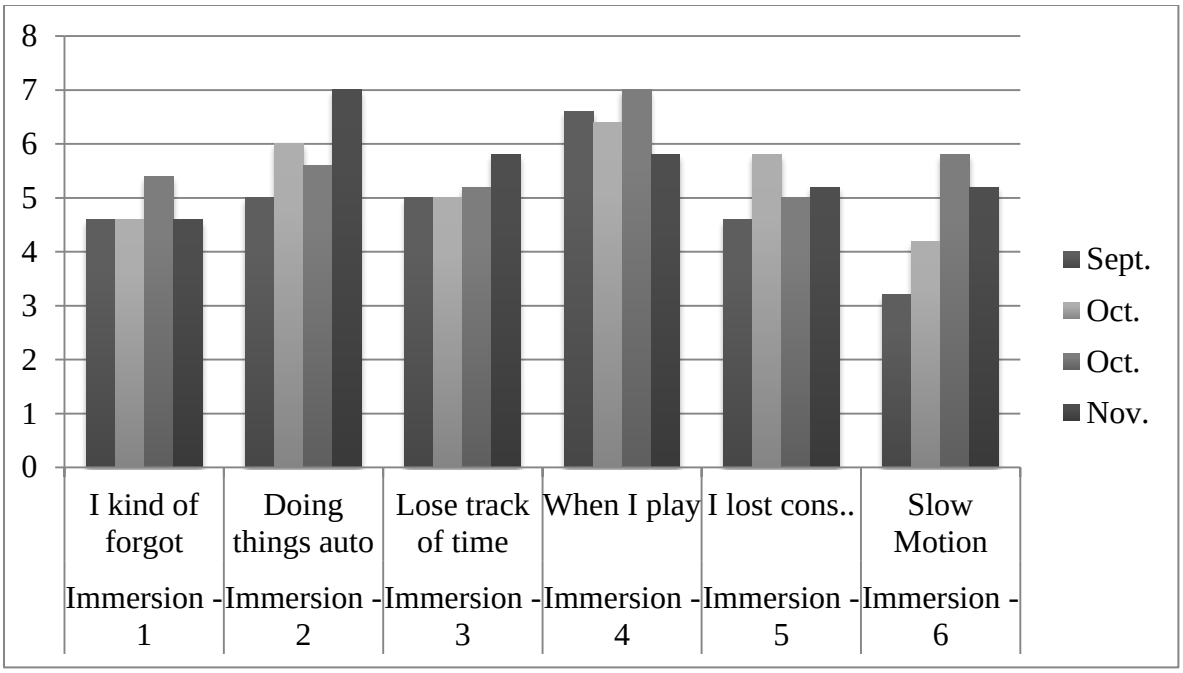


Figure 13. Column graph to display overall participant responses to the "immersion" ESM questions during the first eight-weeks of the intervention.

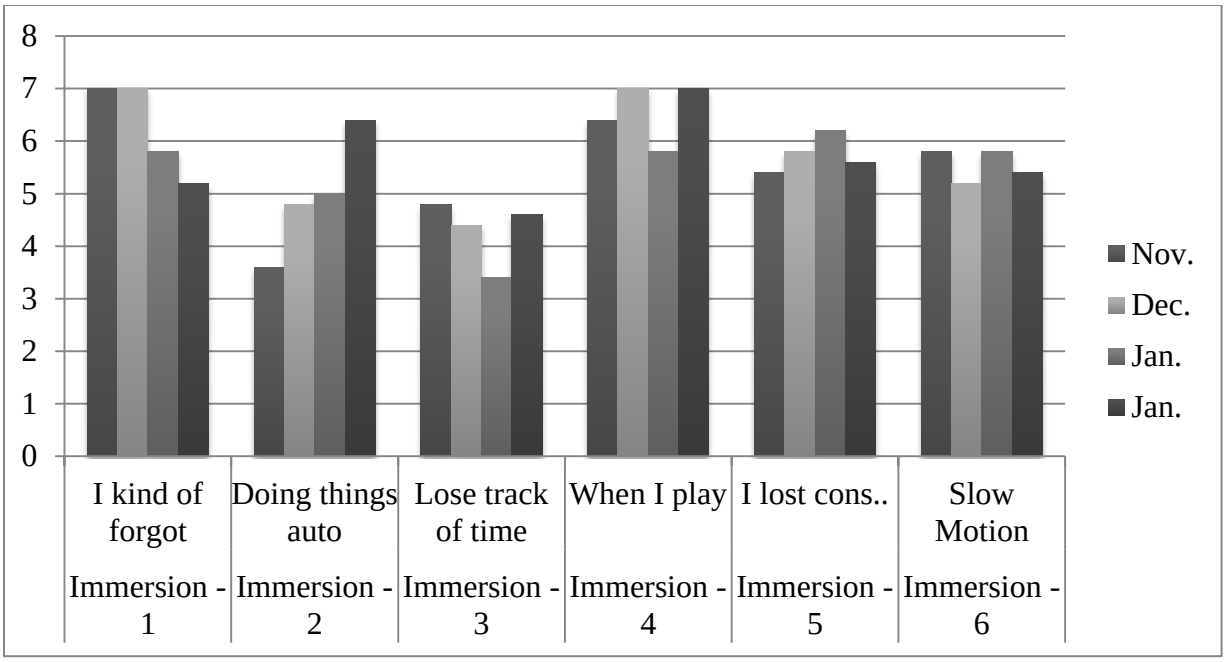


Figure 14. Column graph to display overall participant responses to the "immersion" ESM questions during the second eight-weeks of the intervention.

to pleased," and (e) "mad to glad" were scored higher by Group B in the majority of the data sets.

Figure 15 and Figure 16 display each group's responses on the sad to happy question. Group B's participants responded with more "happy" responses, especially in surveys C and D. Group B scored in the five to seven point ranges with highs in Surveys C and D in the first two weeks of November. Group A also scored within the five to seven point range with a dip to 4.4 on survey B in the last two weeks of September.

Figure 17 displays the male responses to the "bored to eager" question. According to these data, Group B's boys in the study marked maximum responses of seven during every survey administered. Thus, indicating that they were very eager during the study and this was confirmed by the researcher's observations.

Group B also posted higher responses on the "upset to calm" questions. Figure 18 displays Group B's African-American responses to this question. There is a rise in responses from survey B (in the second column) throughout the study. It started with a response of three in the last two weeks of November and grew to the 6.5 to 7 point ranges during the remainder of the study. The same pattern is present for survey C (in the third column) where the responses grow from 4.5 and grow toward the six and seven point ranges. However, there is a dip to four points in the first two weeks of January.

While Group B scored more "pleased" responses for Hispanic students, Group A's Hispanic students also posted in high average of "pleased" responses on these questions. Figure 19 displays the responses for Group A's Hispanic students on the "ashamed to pleased" ESM questions. These student posted average responses in the six and seven point ranges except for a dip of 3.5 on survey B (in the second column) in the first two weeks of September.

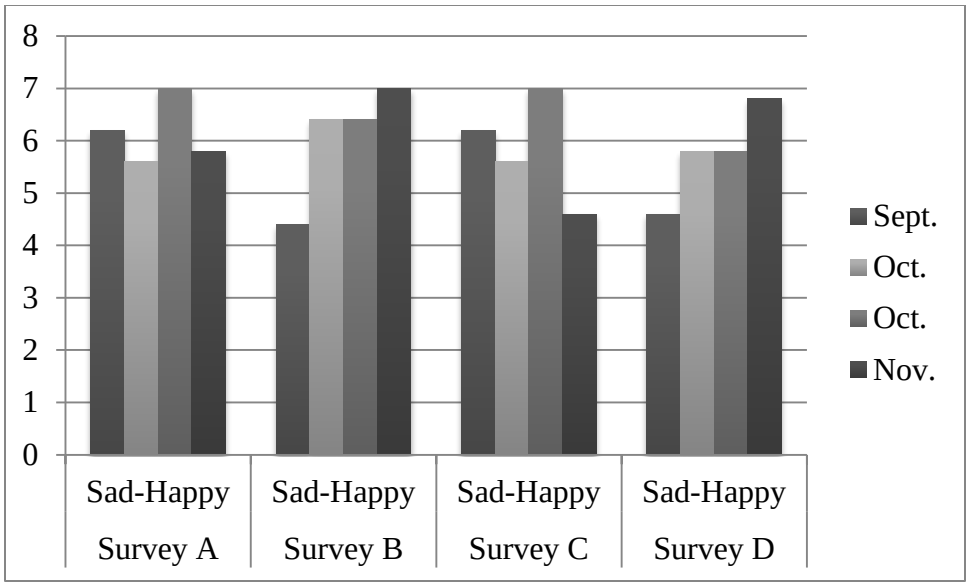


Figure 15. Column graph to display overall Group A participant responses to the "sad to happy" ESM emotion based questions.

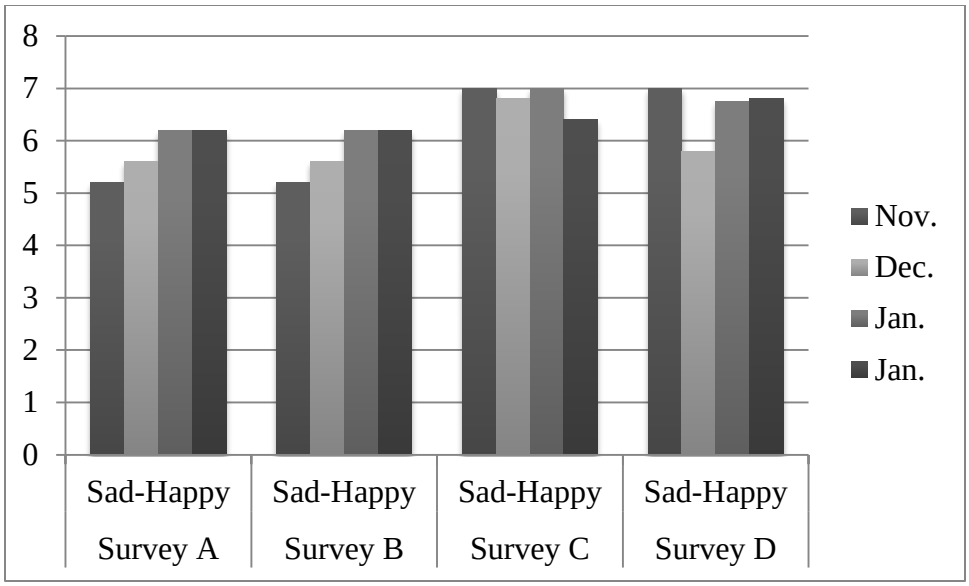


Figure 16. Column graph to display overall Group B participant responses to the "sad to happy" ESM emotion based questions.

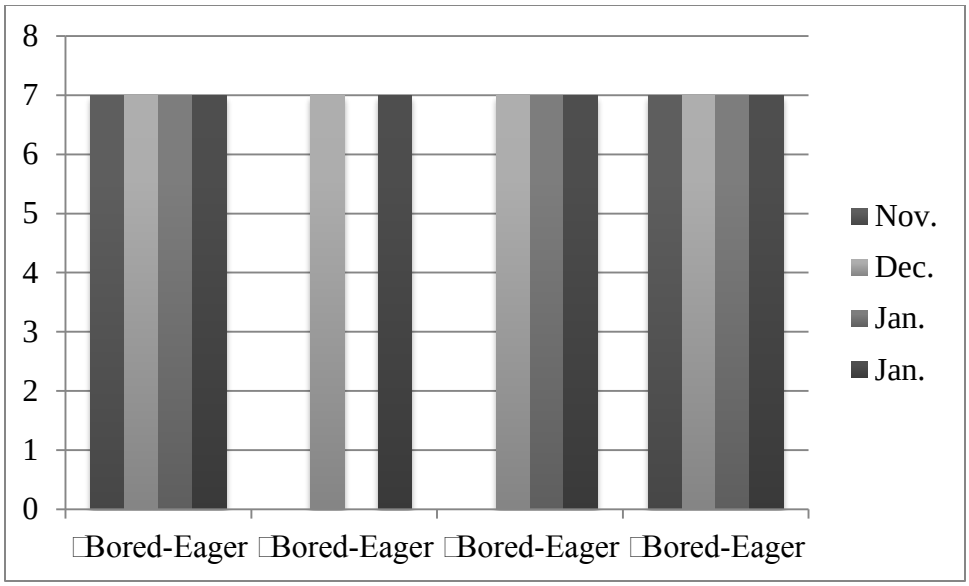


Figure 157. Column graph to display Group B male participant responses to the "bored to eager" ESM emotion based questions.

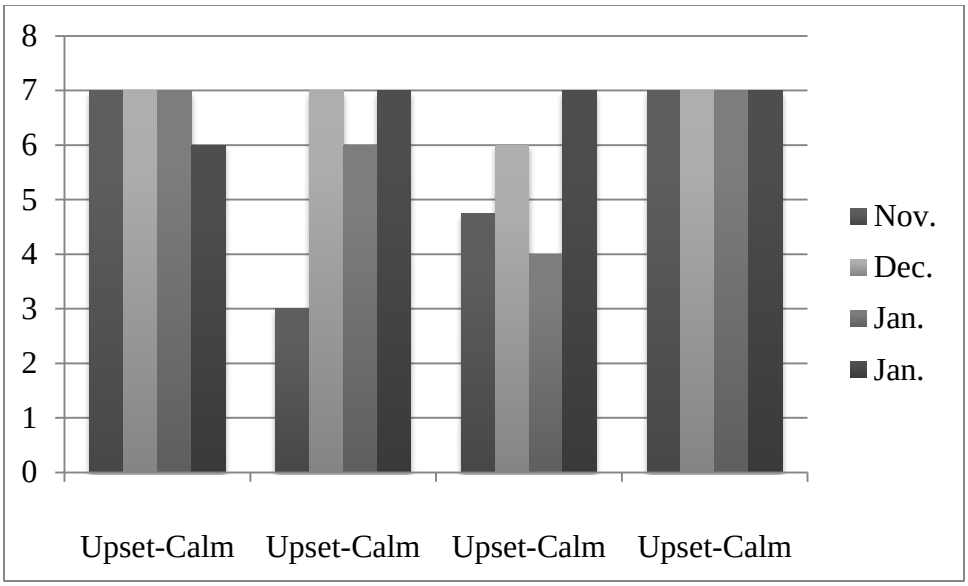


Figure 18. Column graph to display Group B African-American participant responses to the "upset to calm" ESM emotion based questions.

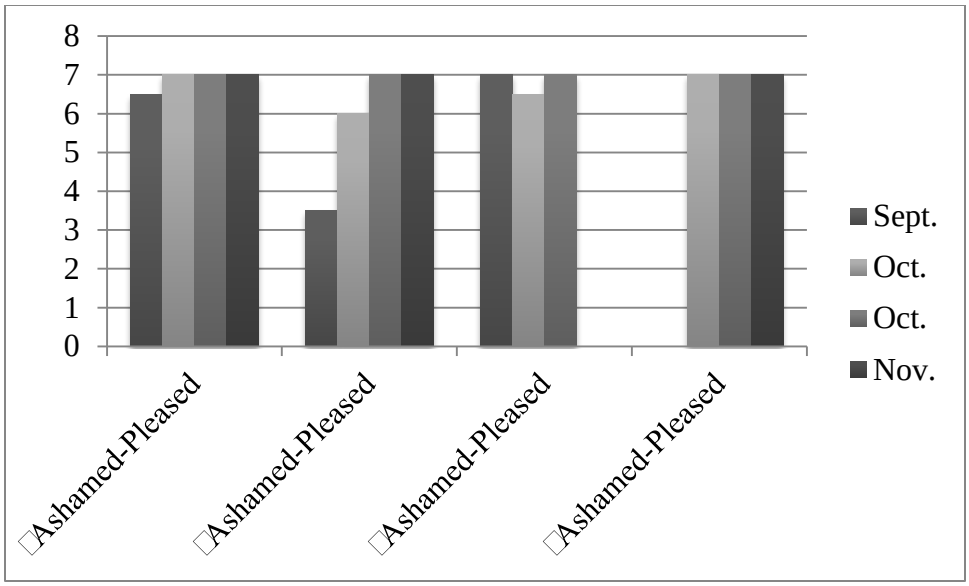


Figure 169. Column graph to display Group A Hispanic participant responses to the "ashamed to

pleased" ESM emotion based questions.

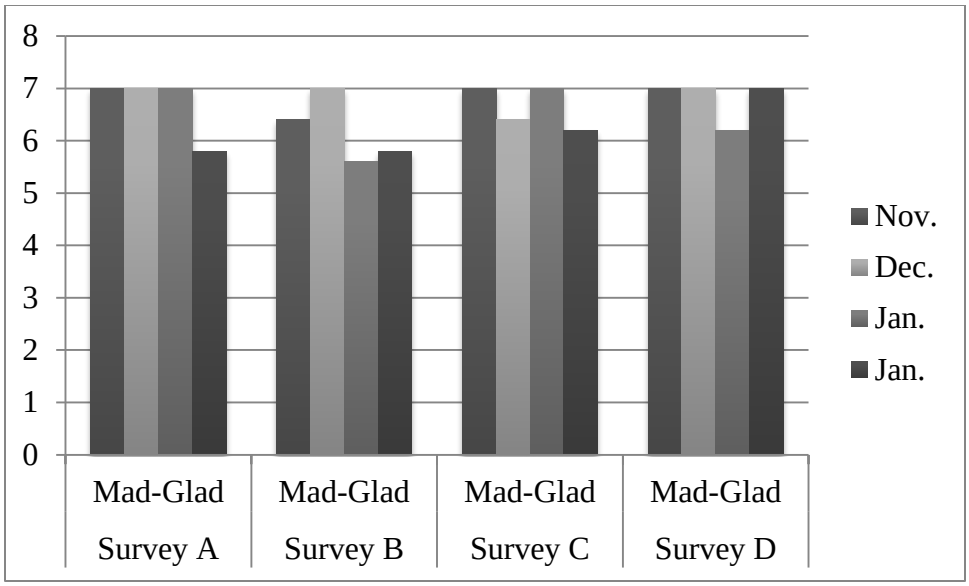


Figure 20. Column graph to display Group B overall participant responses to the "mad to glad" ESM emotion based questions.

Group B's participants had more "glad" responses than their counterparts in Group A. Group B responses averaged 5.8 to 7 during the study with a dip to 5.6 in survey B (in the second column) during the first two weeks of January. The results survey D were also at the maximum response of seven except for a dip to 6.2 in survey D (in the fourth column) during the first two weeks of January.

CHAPTER FIVE: SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS

The purpose of this study was to examine how a videogame-based intervention affected the proficiency of third grade students in the areas of reading comprehension, fluency and other literacy skills. In particular, the superintendent and assistant superintendent were very concerned about the LEA's third grade reading scores in the light of North Carolina legislation that implements a reading proficiency test to be taken by all third grade students. As discussed in Chapter 1, students who do not pass either the end-of-grade reading test, the alternative reading assessment, or do not qualify for an exemption must attend a summer reading camp where they will be retested at the end of that session. If the students are deemed to be non-proficient after the summer reading camp, then the students receive adapted instruction in the fall and are testing again in late October. The results from this last assessment determine whether the students are promoted to the fourth grade. Once again, it is the clear that this LEA wishes to decrease the number of students in such a process due to several concerns, mainly financial.

Specifically, this study explored how the participant's reading comprehension, fluency and other literacy skills changed as measured by Reading 3D, a reading assessment utilized by this school district. The study also examined how this practice affected the participant's state of flow (Csikszentmihalyi, 1975, 1997), as measured by a series of surveys grounded in the experience sampling method (Hektner, Schmidt, & Csikszentmihalyi, 2007; Kubey, Larson & Csikszentmihalyi, 1996). Chapter 4 presented the results of the statistical analysis of data collected via three rounds of Reading 3D benchmark data and surveys of each respondent over the course of a sixteen-week cross-over design intervention where two groups of students were split into two alternating control and experimental groups. This chapter summarizes the findings of the intervention and the meaning of the results for each research question, and then discusses

their implications for school district leadership. Finally, this chapter concludes with limitations relating to the study and suggestions for future research.

Summary of Findings

To address the first two research questions, quantitative data analysis was used to determine whether playing Scribblenauts Unlimited would have had an impact upon student literacy skills. The results of the quantitative data analysis suggested participants who engaged in gameplay utilizing Scribblenauts Unlimited did not display significantly different achievement than students who did not engage in gameplay.

To address the third research question, qualitative data analysis was used to determine if participants in the experimental groups exhibited greater feelings of flow, defined as potentially occurring when the level of challenge presented by the activity and the participants' level of skill occur in balance, thereby creating a deeper level of involvement for the participant (Chen, 2007).

Research Question 1

What will be the effect of "Scribblenauts Unlimited" on student reading comprehension and fluency?

The quantitative data measures for reading comprehension and fluency revealed that the intervention group and control group displayed similar gains for the first eight-weeks of the intervention, so there were no statistically significant data differences. On the other hand, the quantitative data for the second eight-weeks of the intervention revealed that the intervention group did show statistically significant growth in reading comprehension. As discussed in Chapter 4, the second eight-weeks of intervention reported unexpectedly large drops in fluency scores. The LEA where the study was conducted mandated a change in Reading 3D assessors for the MOY benchmarking period even though the North Carolina Department of Public

Instruction required the change during the end-of-year (EOY) benchmark session. Since the first two data points (beginning -of-year or BOY and progress monitoring at the eight-week mark) were conducted by the same assessor and produced some growth between the two measures, I believe the practice of switching the assessors at the MOY benchmark period was a contributing cause to this unexpected variance in data.

Research Question 2

Will the prescribed use of "Scribblenauts Unlimited" improve and expand student vocabulary?

As noted in Chapter 4, there were significant decreases in the qualitative data that arose during the middle-of-year (MOY) benchmark session. As discussed in the first research question, the LEA's decision to switch the assessors at the MOY benchmark period was a definite cause for concern that raises questions regarding the reading assessment data's reliability.

Based on the quantitative data and the observations that I made during each of the intervention sessions, as discussed in the context of the analysis of the qualitative data, there were several instances where students were improving and expanding their vocabulary. Scribblenauts Unlimited offered multiple ways to solve puzzles. For example, when posed with the task of rescuing a cat from a tree, most participants spelled the word "ladder," while others made "jet packs" to complete the puzzle. Other puzzles asked participants to name things that made a plant grow. This prompted the spelling of words such as "oxygen," "soil," "water," and "sunlight." The definition and context of words like, "mobility" and "cranial" were discussed when certain puzzles used these words in their clues.

Research Question 3

What will be the impact of "Scribblenauts Unlimited" on student flow state?

Based on the quantitative data and the observations that I made during each of the intervention sessions, there were many instances where the participants displayed extended period of focus, which highlights the flow elements of "immersion" and "concentration on the task at hand." Whether it was silently pondering what object to create or talking intently with a partner, the participants were mainly focused on the objective of acquiring "starites" and these student interactions heightened the level of engagement, excitement, and pertinent discussion.

The participants of each group also benefited from the formation of collaborative partnerships that sparked discussion and more creative problem solving. These observations highlighted the elements of "challenging activity that requires skill" and "autotelic response." For example, when the second intervention group began to modify their avatars, the trend started with one or two students but quickly spread to a majority of the group through verbal communication and watching each other demonstrate the process. The avatar modifications began with giving their avatar flying abilities, but later grew into making personalized avatars that looked like them.

This study was motivated by my belief that the use of Scribblenauts Unlimited might capitalize on the prevalence and popularity of computer games in today's culture and society. Knowing that today's youth are digital natives who have been immersed in the culture of videogames from an early age, I believe that educators can see games as useful in today's learning environment.

The potential for digital gameplay to enhance learning in classrooms for the children of what Checkley (2015) recently referred to as the "gamer generation" deserves to be taken

seriously. Checkley was supporting the concept of the "gamified classroom" in a newsletter published by ASCD, which is arguably the most widely respected K-12 practitioner-oriented educational organization in the nation. Checkley (2015) referenced the circumstances that led educational gaming pioneer James Paul Gee's being "stunned" (p. 1) by the difficulty level of a digital game he initially expected to be entertaining, as well as by how long it took to play. Juxtaposed against these presumably unattractive characteristics, as highlighted in the literature that supported this study, the market penetration of digital games among younger children is noteworthy. Such market penetration is evidence that there is something about digital games that younger children find alluring. The potential for tapping into the well-spring of younger children's attraction to digital games in order to facilitate educational achievement is what I find alluring.

The extensive qualitative data I collected in the context of this study amply demonstrated the ease with which the participants entered into the Scribblenauts Unlimited genre, and spontaneously set up ad hoc social structures to furnish learning support, creative community, and competition. The impact of these ad hoc structures in facilitating learning in the context of this intervention should not to be underestimated. The existence of such facilitative social structures in the conventional classroom would attest to the teacher's prowess in creating an environment conducive to learning. In the context of this intervention, the participants set up such social structures instinctively.

Against this background, the failure of the quantitative data to yield statistically significant outcomes is disappointing. Although in designing this study I carefully ascertained from the literature what I concluded to be an optimal age-appropriate exposure to Scribblenauts Unlimited, perhaps greater exposure would have been beneficial. The exposure to Scribblenauts

Unlimited was additionally constrained by administrative policies (affecting how often and for how long children could be involved, and how computer resources were maintained and configured) which may have diluted its impact on the quantitative outcomes.

However, the conjectured impact of the preceding factors pales in comparison to the magnitude of the variability of the reading assessments. The seismic changes in reading achievement attributed to individual children call into question the objectivity of a presumably reliable assessment process. At the outset of this study, I presumed that the trained professionals conducting the reading assessments had been trained to some sustainable criterion level with respect to inter-rater reliability. As it transpired, my presumption was in error. Taken in the context of my initial motivation for this study, variability of the order found in this study could see expensive summer school tuition being provided for children that a different assessor would regard as competent.

Gameplay has the potential to provide invaluable opportunities to motivate and engage students, and to expand ways to improve classroom interaction in ways that were not possible before the proliferation of videogames. My hope is to utilize these tools to provide better and more in depth instruction in the future.

Limitations

There are some specific limitations to this study. One of the most important limitations was the design study. While the LEA desires to increase the number of 3rd grade students who achieve proficient scores on Read to Achieve end-of-grade reading assessments, the study only involved two 3rd grade classes in one school. I believe the limited scale of the study impacted its potential for presenting a true picture of how the intervention might affect reading achievement in the LEA.

The second limitation was the unexpected, and yet highly significant, unreliability of the Dibels data in the second eight-week of the intervention. In order to promote the fidelity and reliability of Reading 3D data, the North Carolina Department of Public Instruction requires the switching of assessors during the end-of-year (EOY) benchmark period for the Text Reading and Comprehension (TRC) measure. However, the LEA where this study was conducted went a step further, and required the switching of assessors during the middle-of-year (MOY) benchmark period for the TRC and Dibels measures. Considering that the first two benchmark periods (BOY and progress monitoring at the eight-week mark) yielded small but steady growth in data, the comparatively large drops in data from the MOY benchmark period were an astonishing finding. The data gaps between the two assessors were so conspicuous that they call into question which assessment should be relied on as a measure of reading achievement.

The remaining limitation pertains to the technical issues that prevented the researcher from tracking the number of game levels that each student completed during his or her participation in the intervention. When Scribblenauts Unlimited was installed in the computer laboratory, the LEA's technology staff stated that the game data would be saved in each student's virtual data storage drive. Instead, the game's installation set up the data saving process on each computer's hard drive. This was especially problematic if a student needed to move to another computer in the event that his or her usual computer was not operational. Also, when the student groups switched over in order to begin the second group's intervention, the turnaround time was too short to allow the manual recording of the saved game data from the first group' intervention.

Recommendations

The findings from this study provides encouragement to teachers, administrators, and

other district level educators who are concerned about improving the quality of instruction and student learning through the integration of videogames. The following recommendations showcase the potential for implementing games like Scribblenauts Unlimited.

First, this study highlights the importance of teachers understanding the mechanics and curriculum integration of any game before classroom introduction. This recommendation emerges from this study in that my familiarity with Scribblenauts Unlimited was critical in assisting some students who may have initially experienced frustration when mastering the game's control systems, or in the case of a game like Scribblenauts Unlimited, trying to spell certain words. Students will ask for advice on how to do something or what to do and teachers must be prepared.

This study highlights the significance of teachers understanding that videogames, such as Scribblenauts Unlimited, are not substitutes for effective lesson planning, but are tools that can assist in the learning process. Effective research and planning can ensure that videogames support classroom just like reading a book or watching a movie can be integrated into lessons.

This study also stresses the importance of teachers planning to spend extended time on gameplay. The intervention period for this study lasted for thirty minutes each. However, forty-five minutes was allotted to allow additional time for student seating and login. Scribblenauts Unlimited is best experienced over a period of time that allows participants a chance to think about the variable solutions that the puzzle system provides.

This study highlights the need for school administrators to ensure there are reliable computers that can facilitate gameplay. This may require the purchase of new computers, the timely maintenance of current computers, and the reservation of time for gameplay at regular intervals --, preferably daily. This study encourages educators at all levels to be flexible and be

willing to take risks by allowing their teachers to implement new teaching practices to improve student learning.

Finally, this study stresses the importance of district level administrators and researchers considering a year long intervention with Scribblenauts Unlimited where data differences could be measured from beginning-of-year (BOY), with a switch in control and experimental group roles at the middle-of-year (MOY) mark, and ending with a final measure of growth at the end-of-year (EOY) benchmark period. As discussed in the previous section, this study highlights the importance of maintaining inter-rater reliability among those who perform the benchmark assessments. Additionally, this study points out that it might be in the best interest of the school district to consider retraining all pertinent staff that conducts these assessments in order to strengthen the inter-rater reliability.

Conclusion

Prompted by district-level leadership, this study attempted to address the literacy needs of a target population in a struggling school by applying an intervention that was expected to be engaging and productive for students. While the quantitative data revealed no significant difference in terms of student growth, the qualitative data revealed that the students enjoyed the intervention, and this was evidenced by growth in several elements of flow. Student collaboration was a significant part of the process. The intervention brought about partnerships where students banded together to move through the game levels. All the while, they were spelling and respelling words, and imagining multiple ways to solve problems. These factors led to finding new and innovative ways to reach students and to enrich their educational experience. The positive aspects of this study offer support for further investigation into the impact of utilizing computer games in the classroom to improve student learning.

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APPENDIX A: LETTER OF SUPPORT FROM CHRIS MANSFIELD

Martin County Schools
"Working Together… Making a Difference!"

300 North Watts Street
Williamston, North Carolina 27892
252-792-1575 (Telephone) 252-792-1965 (Fax)
www.martin.k12.nc.us

July 15, 2013

Dr. James McDowelle, Professor
Department of Educational Leadership
College of Education, East Carolina University
Greenville, NC 27858

Dear Dr. McDowelle,

As Assistant Superintendent of Martin County Schools, I am writing to provide both consent and support to the research project, *Using Game Based Learning to Increase Reading Comprehension and Improve Literacy Skills for 3rd Grade Players*, at East End Elementary School.

Over the past several years Martin County third graders including many at East End Elementary School have demonstrated inadequate reading comprehension and other literacy skills. This problem has continued in spite of the time and money spent through programs such as Corrective Reading and Reading Recovery and through initiatives such as Reading First.
Norris Parker, principal investigator and principal at East End, has witnessed this problem first hand and knows too well the consequences of these inadequate skills--consequences ranging from low self-esteem to discipline problems to retention.

Mr. Parker's proposal to examine whether game based learning can increase these literacy skills among third graders is both timely and intriguing. While many would brush aside the instructional effects of video gaming, there is a body of work that suggests that gaming may provide a hook and scaffolding for some reluctant learners.

Martin County Schools supports Mr. Parker and this research initiative provided the following conditions are met:
1. All appropriate FERPA guidelines are followed;
2. Parental consent is obtained for players participating in the research protocol; and,
3. The study passes all IRB recommendations at the University level.

Sincerely,

Dr. Chris Mansfield, Assistant Superintendent

APPENDIX B: THE SPACHE WORD LIST

A

a | able | about | above | across | act | add | afraid | after | afternoon | again | against | ago | air | airplane | alarm | all | almost | alone | along | already | also | always | am | among | an | and | angry | animal | another | answer | any | anyone | appear | apple | are | arm | around | arrow | as | ask | asleep | at | ate | attention | aunt | awake | away

B

| b | baby | back | bad | bag | ball | balloon | bang | bank | bark | barn | basket | be | bean | bear | beat | beautiful | became | because | become | bed | bee | been | before | began | begin | behind | believe | bell | belong | bend | bent | beside | best | better | between | big | bird | birthday | bit | bite | black | blanket | blew | block | blow | blue | board | boat | book | boot | born | borrow | both | bother | bottle | bottom | bought | bow | box | boy | branch | brave | bread | break | breakfast | breath | brick | bridge | bright | bring | broke | broken | brother | brought | brown | brush | build | bump | burn | bus | busy | but | butter | button | buy | by

C

| c | cabin | cage | cake | call | came | camp | can | candle | candy | can\t | cap | captain | car | card | care | careful | carrot | carry | case | castle | cat | catch | cattle | caught | cause | cent | certain | chair | chance | change | chase | chicken | chief | child | children | church | circle | circus | city | clap | clean | clever | cliff | climb | clock | close | cloth | clothes | clown | coat | cold | color | come | comfortable | company | contest | continue | cook | cool | corner | could | count | country | course | cover | cow | crawl | cream | cry | cup | curtain | cut

D

| d | Dad | dance | danger | dangerous | dark | dash | daughter | day | dear | decide | deep | desk | did | didn\t | die | different | dig | dinner | direction | disappear | disappoint | discover | distance | do | doctor | does | dog | dollar | done | don\t | door | down | dragon | dream | dress | drink | drive | drop | drove | dry | duck | during | dust

E

| e | each | eager | ear | early | earn | earth | easy | eat | edge | egg | eight | eighteen | either | elephant | else | empty | end | enemy | enough | enter | even | ever | every | everything | exact | except | excite | exclaim | explain | eye

F

| face | fact | fair | fall | family | far | farm | farmer | farther | fast | fat | father | feather | feed | feel | feet | fell | fellow | felt | fence | few | field | fierce | fight | figure | fill | final | find | fine | finger | finish | fire | first | fish | five | flag | flash | flat | flew | floor | flower | fly | follow | food | for | forest | forget | forth | found | four | fourth | fox | fresh | friend | frighten | frog | from | front | fruit | full | fun | funny | fur

G

| g | game | garden | gasp | gate | gave | get | giant | gift | girl | give | glad | glass | go | goat | gone | good | got | grandfather | grandmother | grass | gray | great | green | grew | grin | ground | group | grow | growl | guess | gun

H

| h | had | hair | half | hall | hand | handle | hang | happen | happiness | happy | hard | harm | has | hat | hate | have | he | head | hear | heard | heavy | held | hello | help | hen | her | here | herself | he\s | hid | hide | high | hill | him | himself | his | hit | hold | hole | holiday | home | honey | hop | horn | horse | hot | hour | house | how | howl | hum | hundred | hung | hungry | hunt | hurry | hurt | husband | i | I | ice | idea | if | I\ll | I\m | imagine | important | in | inch | indeed | inside | instead | into | invite | is | it | it\s | its

I

| i | I | ice | idea | if | I\ll | I\m | imagine | important | in | inch | indeed | inside | instead | into | invite | is | it | it\s | its

J

| j | jacket | jar | jet | job | join | joke | joy | jump | just

K

| k | keep | kept | key | kick | kill | kind | king | kitchen | kitten | knee | knew | knock | know

L

| l | ladder | lady | laid | lake | land | large | last | late | laugh | lay | lazy | lead | leap | learn | least | leave | left | leg | less | let | let\s | letter | lick | lift | light | like | line | lion | list | listen | little | live | load | long | look | lost | lot | loud | love | low | luck | lump | lunch

M

| m | machine | made | magic | mail | make | man | many | march | mark | market | master | matter | may | maybe | me | mean | meant | meat | meet | melt | men | merry | met | middle | might | mile | milk | milkman | mind | mine | minute | miss | mistake | moment | money | monkey | month | more | morning | most | mother | mountain | mouse | mouth | move | much | mud | music | must | my | n | name | near | neck | need | needle | neighbor | neighborhood | nest | never | new | next | nibble | nice | night | nine | no | nod | noise | none | north | nose | not | note | nothing | notice | now | number

N

| n | name | near | neck | need | needle | neighbor | neighborhood | nest | never | new | next | nibble | nice | night | nine | no | nod | noise | none | north | nose | not | note | nothing | notice | now | number

O

| o | ocean | of | off | offer | often | oh | old | on | once | one | only | open | or | orange | order | other | our | out | outside | over | owl | own

P

| p | pack | paid | pail | paint | pair | palace | pan | paper | parade | parent | park | part | party | pass | past | pasture | path | paw | pay | peanut | peek | pen | penny | people | perfect | perhaps | person | pet | pick | picnic | picture | pie | piece | pig | pile | pin | place | plan | plant | play | pleasant | please | plenty | plow | picket | point | poke | pole | policeman | pond | poor | pop | postman | pot | potato | pound | pour | practice | prepare | present | pretend | pretty | princess | prize | probably | problem | promise | protect | proud | puff | pull | puppy | push | put

Q

| q | queen | queer | quick | quiet | quite

R

| r | rabbit | raccoon | race | radio | rag | rain | raise | ran | ranch | rang | reach | read | ready | real | red | refuse | remember | reply | rest | return | reward | rich | ride | right | ring | river | road | roar | rock | rode | roll | roof | room | rope | round | row | rub | rule | run | rush

S

| s | sad | safe | said | sail | sale | salt | same | sand | sang | sat | save | saw | say | scare | school | scold | scratch | scream | sea | seat | second | secret | see | seed | seem | seen | sell | send | sent | seven | several | sew | shadow | shake | shall | shape | she | sheep | shell | shine | ship | shoe | shone | shook | shoot | shop | shore | short | shot | should | show | sick | side | sight | sign | signal | silent | silly | silver | since | sing | sister | sit | six | size | skip | sky | sled | sleep | slid | slide | slow | small | smart | smell | smile | smoke | snap | sniff | snow | so | soft | sold | some | something | sometimes | son | song | soon | sorry | sound | speak | special | spend | spill | splash | spoke | spot | spread | spring | squirrel | stand | star | start | station | stay | step | stick | still | stone | stood | stop | store | story | straight | strange | street | stretch | strike | strong | such | sudden | sugar | suit | summer | sun | supper | suppose | sure | surprise | swallow | sweet | swim | swing

T

| t | table | tail | take | talk | tall | tap | taste | teach | teacher | team | tear | teeth | telephone | tell | ten | tent | than | thank | that | that\s | the | their | them | then | there | these | they | thick | thin | thing | think | third | this | those | though | thought | three | threw | through | throw | tie | tiger | tight | time | tiny | tip | tire | to | today | toe | together | told | tomorrow | too | took | tooth | top | touch | toward | tower | town | toy | track | traffic | train | trap | tree | trick | trip | trot | truck | true | trunk | try | turkey | turn | turtle | twelve | twin | two

U

| u | ugly | uncle | under | unhappy | until | up | upon | upstairs | us | use | usual

V

| v | valley | vegetable | very | village | visit | voice

W

| w | wag | wagon | wait | wake | walk | want | war | warm | was | wash | waste | watch | water | wave | way | we | wear | weather | week | well | went | were | wet | what | wheel | when | where | which | while | whisper | whistle | white | who | whole | whose | why | wide | wife | will | win | wind | window | wing | wink | winter | wire | wise | wish | with | without | woke | wolf | woman | women | wonder | won\t | wood | word | wore | work | world | worm | worry | worth | would | wrong

X - Y

| x | y | yard | year | yell | yellow | yes | yet | you | young | your

Z

| z | zoo

APPENDIX C: PARENT CONSENT FORM

Dear Parent/Guardian,

I am presently working on my doctoral degree in Education Leadership at East Carolina University. As part of my degree requirements, I am planning an educational research project to take place in the computer laboratory that will help me to learn more about how to improve the literacy skills of all our third grade students. The fundamental goal of this research study is improve your child's vocabulary, reading fluency, and performance on end-of-grade testing.

As part of this research project in the computer laboratory, your child will participate in an intervention that will use Scribblenauts Unlimited, a puzzle-based videogame. During this study, participants will be split into two groups. One group will be asked to use Scribblenauts during two thirty-minute sessions per week for the first eight-week period in addition to the normal reading program, while the other group receives just the normal reading program. The group roles will be reversed during the second eight-week period. This study will allow me to track growth in Reading 3D data and your child's perception of the game through video capture and various surveys. As this study is for educational research purposes only, the results of your child's participation **will not** affect your child's grade.

I am requesting permission from you to use your child's data in my research study. Please know that participation is entirely voluntary.

If you have any questions or concerns, please feel free to contact me at school at 252-795-4775 or by emailing me at nparker@martin.k12.nc.us. If you have questions about your child's rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (weekdays, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the OHRI, at 252-744-1971.

If you permit your child's data to be used in my study, please return the attached form by September 30, 2014. Thank you for your interest in my educational research study.

Your Partner in Education,

Norris Parker, Principal of East End Elementary School

As the parent or guardian of _____,

(write your student's name)

☐ **I grant my permission for Mr. Parker to use my child's data in his or her educational research project regarding the reading comprehension and fluency of third grade students. I fully understand that my child's data will be kept completely confidential and will be used only for the purposes of Mr. Parker's research study. I also understand that I or my child may at anytime decide to withdraw my/our permission and that my child's grade will not be affected by withdrawing from the study.**

☐ **I do NOT grant my permission for Mr. Parker to use my child's data in his or her educational research project regarding the reading comprehension and fluency of third grade students.**

Signature of Parent/Guardian:_____ Date_____

APPENDIX D: STUDENT VERBAL ASSENT SCRIPT

Hi.

I am trying to learn about how to use videogames to improve reading skills of third grade students. I would like to ask you to help me by being in a study, but before I do, I want to explain what will happen if you decide to help me.

I will ask you to play a videogame called Scribblenauts Unlimited in the computer lab. You will be in one of two groups. One group will be asked to use Scribblenauts during two thirty-minute sessions per week for the first eight-week period in addition to the normal reading program. The other group will use the normal reading program. In the next eight-week period, the groups will switch.

Small groups of students will be videoed while they use Scribblenauts, and then I might ask one or two of you to tell me what you were thinking about in a particular part of the video. You will also be asked to fill in a short survey during a few of the Scribblenauts sessions.

When I tell other people about my study, I will not use your name, and no one will be able to tell that I am talking about you. Your (Mom/Dad, etc.) says it its okay for you to be in this study, but if you don't want to be in the study, you don't have to be.

What you decide won't make any difference in your grade in any way. I won't be upset, and no one else will be upset if you don't want to be in the study. If you want to be in the study now, but change your mind later, that's fine. You can stop at any time.

Do you have any questions for me now?

Would you like to be in this study?

APPENDIX E: ESM SURVEY A

These short ESM surveys were distributed during “Scribblenauts Unlimited” sessions to targeted small groups of participants.

ESM Survey A

Playing this game challenges me.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I know clearly what I wanted to do in this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

My attention was focused entirely on the game that I was playing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I feel comfortable with the controls of this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I kind of forgot about myself when playing this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

What is your mood?

Sad Happy

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Bored Eager

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Upset Calm

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Ashamed Pleased

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Mad Glad

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

APPENDIX F: ESM SURVEY B

These short ESM surveys were distributed during “Scribblenauts Unlimited” sessions to targeted small groups of participants.

ESM Survey B

Playing this game could provide a good test of my skills.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I knew what I wanted to achieve in this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

When playing this game, I was totally concentrated on what I was doing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

When playing this game, I felt in control over what I was doing in the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I often find myself doing things automatically without having to think.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

When I play this game, I tend to lose track of time.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

What is your mood?

Sad Happy

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Bored Eager

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Upset Calm

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Ashamed Pleased

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Mad Glad

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

APPENDIX G: ESM SURVEY C

These short ESM surveys were distributed during “Scribblenauts Unlimited” sessions to targeted small groups of participants.

ESM Survey C

I find that playing this game stretches my abilities to my limits.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

My goals were clearly defined.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

While playing this game, I had a good idea about how well I was doing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

When I play the game, I feel I am in a world created by the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Playing this game is rewarding in itself.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I receive immediate feedback of my actions.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

What is your mood?

Sad Happy

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Bored Eager

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Upset Calm

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Ashamed Pleased

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Mad Glad

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

APPENDIX H: ESM SURVEY D

These short ESM surveys were distributed during "Scribblenauts Unlimited" sessions to targeted small groups of participants.

ESM Survey D

I was challenged by this game, but I can overcome these challenges.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I was aware of how well I was performing in the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I lost the consciousness of my identity and felt like "melted" into the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I loved the feeling of that performance and want to capture it again.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

When I play the game, I sometimes felt like things were happening in slow motion.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

I enjoyed the experience.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

What is your mood?

Sad Happy

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Bored Eager

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Upset Calm

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Ashamed Pleased

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Mad Glad

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

APPENDIX I: EIGHT-WEEK INTERVENTION SESSION SURVEY

This survey was administered at the end of each eight-week intervention session to measure the participants' flow experiences during "Scribblenauts Unlimited."

Directions: Please circle the number that best describes how you feel about each question.

Element of Flow - A challenging activity that requires skills

1. Playing this game challenges me.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

2. Playing this game could provide a good test of my skills.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

3. I find that playing this game stretches my abilities to my limits.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

4. I was challenged by this game, but I can overcome these challenges.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Element of Flow - Clear goals and feedback

5. I know clearly what I wanted to do in this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

6. I knew what I wanted to achieve in this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

7. My goals were clearly defined.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

8. While playing this game, I had a good idea about how well I was doing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

9. I was aware of how well I was performing in this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

10. I receive immediate feedback of my actions.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Element of Flow - Concentration on the task at hand

11. My attention was focused entirely on the game that I was playing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

12. When playing this game, I was totally concentrated on what I was doing.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Element of Flow - The paradox of control

13. When playing this game, I felt in control over what I was doing in the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

14. I feel comfortable with the controls of this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Element of Flow - Immersion (Loss of self-consciousness, The merging of action and awareness, The transformation of time)

15. I often find myself doing things automatically without having to think.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

16. When I play the game, I feel I am in a world created by the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

17. I kind of forgot about myself when playing this game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

18. I lost the consciousness of my identity and felt like “melted” into the game.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

19. When I play the game, I sometimes felt like things were happening in slow motion.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

20. When I play this game, I tend to lose track of time.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

Element of Flow - Autotelic experience

21. Playing this game is rewarding in itself.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

22. I loved the feeling of that performance and want to capture it again.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

23. I enjoyed the experience.

Low			Undecided			High
☹			😐			☺
1	2	3	4	5	6	7

APPENDIX J: INSTITUTIONAL REVIEW BOARD APPROVAL LETTER

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **www.ecu.edu/irb**

Notification of Initial Approval: Expedited

From: Social/Behavioral IRB
To: Norris Parker
CC: Robert Reardon
Date: 9/29/2014
Re: UMCIRB 14-001462
Utilizing Scribblenauts to Increase Reading Comprehension and Improve Literacy Skills of Third Grade Students

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 9/26/2014 to 9/25/2015. The research study is eligible for review under expedited category #6, 7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Appendix D	Surveys and Questionnaires
Appendix E	Surveys and Questionnaires
Interview-Focus Group Sample Questions	Interview/Focus Group Scripts/Questions
LEED Proposal	Study Protocol or Grant Application
Parent Consent Letter	Consent Forms
Sample Interview Questions	Interview/Focus Group Scripts/Questions
Student Verbal Assent	Consent Forms
Study Protocol	Study Protocol or Grant Application

The Chairperson (or designee) does not have a potential for conflict of interest on this study.