EFFECTS OF DIGITAL GAMING ON HIGHER ORDER THINKING: EXPLORING CORRELATIONS BETWEEN DIGITAL GAMING AND READING COMPREHENSION

FITZGERALD

EFFECTS OF DIGITAL GAMING ON HIGHER ORDER THINKING: EXPLORING CORRELATIONS BETWEEN DIGITAL GAMING AND READING COMPREHENSION

by
Emma Fitzgerald

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Honors Committee

Dr. Cathy Freytag, Chair	Signature: Cathy E. Freytag
Dr. Connie Finney	Signature: Constance R. Finney
Professor David Huth	Signature: DHE Huth

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INTRODUCTION

Background

Video games are indisputably one of the most popular forms of entertainment for children today. Since the early 1970s, when the first video games were created, the number of video game players has reached approximately 145 million (Etuk, 2008). The considerable amount of time that many students spend playing video games has sparked the interest of parents, educators, theorists, and researchers: What is it about video games that entices children? Can this digital medium be harnessed to serve the purposes of schools? Research on this topic remains relatively sparse, leaving significant gaps in our understanding. Critical to confirming or rejecting the current theories about the effects of digital games on students' learning is the accumulation of more conclusive evidence through continued research (Din & Calao, 2001; Ferdig, 2007; Squire, 2006; Warren, Dondlinger, & Barab, 2008). It is the intent of this study to contribute to the research on the effects of digital gaming on higher order thinking, a vast issue that has been inquisitively mentioned in recent literature, but remains largely uninvestigated.

Broadly speaking, the relationship between gaming and learning has been approached from multiple perspectives, each one with its own set of questions. Depending on the sphere of interest, approaches to the relationship between gaming and learning vary accordingly.

Parents have typically been concerned with the nature of the content in digital games: are they too violent; are there sexual references; what kind of language is being used? The assumption that is made by many parents is that video game content is likely to affect their child's behavior and cause him/her to act out in violence, engage in sexual acts, or adopt inappropriate language. Indeed, the link – supposed to be negative – between the content of video games and the behavior of gamers is the most frequently voiced by the general public (Olson, 2009).

In contrast, although they retain similar assumptions, educators are curious about the potentially positive effects that digital games might have on their students. Also similar to parents, their focus has been primarily on the content of the games. If students are motivated to play these digital games, why not create games that have educational content? In 1984, game designers responded to this question resulting in the creation of several educational video games, then called "edutainment", including: *Math Blaster, Reader Rabbit, Oregon Trail, and Where in the World is Carmen Sandiego?* (Etuk, 2008). Since these pioneers, countless other educational video games have been marketed to schools and households.

It was the intention of educational game developers that these new educational games differ from popular games only in their content. However, the reality is that educational games are incomparable to many popular games with regards to their design (Rice, 2007; Squire, 2006). The medium itself is of higher quality in popular digital games (Rice, 2007).

The focus of theorists has been on the nature of the medium rather than the content. What motivates children to play video games? How do video game developers

package their content in such a way that children are drawn to playing them? James Gee, Marc Prensky, Kurt Squire, and others are beginning to reveal the essential components that make digital video games inviting and effective including: interactivity, agency, and immersive environments. (The term "effective" is used here to mean the successful achievement of whatever the intended purpose is in playing the game whether it is academic learning or simply entertainment.)

In recent years, researchers have begun to document the effectiveness of educational video games (Din & Calao, 2001; DiPietro, Ferdig, Boyer, & Black, 2007; Ferdig, 2007; Rosas et al., 2003; Warren et al., 2008). They are asking questions like: How successful are digital games at improving students' academic achievement? What are the pedagogical foundations of these educational video games? The focus of the research to date has been on how digital games impact *what* the game players know and can demonstrate, whether it is violent conduct, academic achievement, or improved fine motor skills. The answer to questions regarding the ways in which digital games effect *how* their players *think* is a question that is left largely unanswered and unexamined by research.

Purpose of the Study

Dr. Patricia Greenfield (2009) asserts that students are acquiring a whole "new profile of cognitive skills" (p.53) due to the pervasive use of digital technology. Greenfield and others are concerned about the impact that digital technology is having on our brains and the possibility that it is altering our ability to think critically (Greenfield, 2009; Greengard, 2009; Small, 2009; Wolf & Barzillai, 2009). The purpose of this research is to investigate the relationship between students' gaming habits and their

higher order thinking skills, which include critical thinking. It is not intended that this research will draw causational conclusions, but rather explore possible correlations between these two elements in students.

In studies conducted by Kagan and Terenzini (as cited in Greenfield, 2009) reading comprehension was found to be linked with higher order thinking skills such as critical thinking, reflection, imagination, inferential and deductive reasoning, and analytical skills. Based on this evidence, the present study will focus on the correlative relationship between students' gaming habits and their reading comprehension skills as one indicator of critical thought.

Hypothesis

The objective of this study is to investigate the potential correlation between students' gaming habits and their ability to employ higher order thinking, as demonstrated by their reading comprehension skills. With this purpose in mind, the following hypothesis was undertaken:

> There is a negative correlation between digital gaming and reading comprehension (higher order thinking): the more students play video games, the lower they will perform on a reading comprehension assessment, suggesting low levels of higher order thinking skills.

Definition of Terms

The following definitions will be assumed for these terms that are relevant to this study:

Agency: The authorship given to game players (Squire, 2006; Gee, 2007). Authorship refers to the fact that the "narrative fiction of the gameworld and its rules" are

heavily determined by the "players' actions in creating the experience" (Squire, 2006, p. 21).

Deep Reading: "...The array of sophisticated processes that propel comprehension and that include inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight" (Wolf & Barzillai, 2009, p.32).

Digital Games: Electronic games played on computers or game consoles, as distinguishable from non-electronic games and simulations.

Higher Order Thinking: This includes skills such as critical thinking, reflection, inductive/inferential reasoning, deductive reasoning, problem-solving, imagination, analyzing, synthesizing (Greenfield, 2009; Wolf & Barzillai, 2009).

Interactivity: The reciprocal responsiveness between game and players (Gee, 2007).

Limited Attention: This refers to the reality that the human brain can think about a limited amount of information at one time (Hallowell, 2009; Restak, 2009).

Neuroplasticity: The ability of the human brain to form new connections and pathways based on sensory experiences (Willis, 2009; Wolf & Barzillai, 2009).

Working memory: The "mental scratchpad" for executive functioning; the system that allows us to hold information "on line," to maintain it over an interval, and manipulate it (Farah, 2009).

Research Design

Population

The participants in this study are both male and female grade five students from a rural middle school in western New York. This population was chosen based on the

relationships that were formed between the grade 5 students, their teachers, and the investigator during a student teaching experience. This allowed the study to be conducted with a sufficiently large group of students who could flexibly participate in the various components of the study. The researcher obtained the necessary permissions from the parents/guardians of the 10 participants (see Appendices A and B). All four of the grade five teachers and the middle school principal agreed to the terms of the study.

Data Collection and Analysis

Three initial written surveys that aimed to gauge students' gaming and reading attitudes and habits were administered to all 72 grade five students. These required no parental permissions since the classroom teacher considered them to be standard surveys that could have been administered in the regular course of classroom learning. The times and dates for the administration of these surveys were predetermined through consultation with the grade five English Language Arts (ELA) teacher, whose class time was used. From these 72 students, ten were selected to participate in the *Woodcock Reading Mastery Test – Revised* (WRMT-R). The times and dates for the administration of this more extensive testing was also predetermined through consultation with the grade five ELA teacher as well as the middle school principal. To supplement this data, the practice test scores from the reading comprehension portion of the Grade 5 New York State ELA Test were obtained from the grade 5 ELA teacher for the ten selected students.

The data from these five instruments were entered into SPSS Version 14.0 (2005) statistical software. Pearson correlation tests were used to investigate statistically significant correlations between data.

Assumptions

The following assumptions are maintained with regards to this study:

1. A student's abilities to read "deeply," comprehend passages, and interpret analogous relationships between words are significant indicators of his/her ability to employ and demonstrate the faculties of higher order thinking.
2. The responses given in each of the students' three surveys are truthful, honest accounts of their attitudes and habits in the areas of digital gaming and reading.

Limitations

The results and conclusions of this study are limited by the following:

1. Due to lack of funding, time and access, a more comprehensive assessment of each student's gaming habits and higher order thinking skills could not be obtained. Therefore, the results are not complete reflections of these two elements in each student.
2. The data collected were restricted to one grade level in one school. The patterns of a larger population sample would provide the evidential grounds for stronger conclusions.
3. There is the likelihood that bias is reflected in the conclusions of the study due to the fact that the investigator accumulated a wealth of background knowledge during a student teaching experience with the students who were included in this study.

Significance of the Study

Digital technology has revolutionized communication, "wikified" knowledge and information, and monopolized leisure activities in the last century (Kosik, 2009). In order to respond appropriately to this reality, especially with regards to supporting, protecting, and preparing this and future generations of students, educators and researchers must

critically evaluate digital media in order to avoid potentially negative consequences of these changes. It is vital that parents, educators, theorists, and researchers work together in determining the necessary steps towards harnessing this digital medium in order to use it wisely. Otherwise, as some have already begun to lament (Greengard, 2009; Greenfield, 2009; Hallowell, 2009; Small, 2009), it will begin to (or perhaps continue to) affect us in ways that we do not intend or desire.

It is no secret that vast numbers of people, our students included, are allured by this medium and spend a great deal of time engaging in video game play. Although it is important to study the effects that game content can have on our students, it has become evident that there is extensive implicit instruction that occurs through video game play (Greenfield, 2009), and that content is not the sole influential component in digital games. Many have conjectured that video games, along with other digital technologies, may be altering our brains and the way that we think; specifically, the concern is that digital technologies are affecting our ability to think critically and exercise the functions of higher order thinking (Greenfield, 2009; Greengard, 2009; Small, 2009; Willis, 2009; Wolf & Barzillai, 2009). There has, however, been almost no research done to support or reject this theory. It is the purpose of this study to contribute to this discussion and to the research on this growing concern through an investigation of the effects that digital games may have on reading comprehension and, by association, higher order thinking.

With regard to education, the results of all further research on the relationship between video gaming and learning will either support or discourage the proactive inclusion of video games in school curricula.

Chapter II

REVIEW OF LITERATURE

Theory and research from several fields of study, including neuroscience, education, and psychology, contribute to the focus of this research. The intersections of these fields create a kaleidoscopic view of the relationship between digital gaming and higher order thinking. It is, therefore, fitting to outline some of the pertinent angles and shades that these branches of learning have contributed with regard to the relationship between digital gaming and learning. This contextualization will serve to highlight the significance of this study.

Higher Order Thinking

The concept of higher order thinking can be defined in a variety of ways. Dr. Patricia Greenfield (2009) discusses this concept using the terms "scientific thinking" (p.71) and "deep processing" (p.71) to refer to "reflection, inductive analysis, critical thinking, mindful thought, and imagination" (p.71). In several instances, *critical thinking* is employed as a synecdoche, representing the larger category of higher order thinking (Greengard, 2009; Small, 2009; Zawilinski, 2009). Samuel Greengard (2009) describes critical thinking as "the ability to think beyond the ordinary" (p.18). In the strictly scientific realm, Judy Willis (2009) calls this kind of thinking "highest cognition", defining it in this way:

> Organizing, judging, prioritizing, developing plans and goals, working toward goal accomplishment, balance and control of emotions, anticipating future

> consequences of present actions, monitoring what one says and does, analyzing past thoughts and behaviors, projecting into the future, and making strategic adaptations. (Highest Cognition and Executive Function section, para. 2)

Willis (2009) states that this "highest cognition" goes "beyond just remembering information" to being able to"[apply]...knowledge to new situations, decision-making, analysis, and judgment" (Highest Cognition and Executive Function section, para. 2).

While remaining mindful of these diverse perspectives on the definition of higher order thinking, it is also helpful to consider Bloom's Taxonomy (Woolfolk, 2007). Bloom defines thinking using six categories: remembering, understanding, applying, analyzing, evaluating, and creating. For the purposes of this discussion, a relatively broad definition will be assumed for higher order thinking. However, for the sake of clarity, the last four levels of Bloom's Taxonomy – applying, analyzing, evaluating, and creating – and especially the last three, provide a rough summary of how higher order thinking is generally defined in the context of this review and research.

Significance of Higher Order Thinking

Unquestionably, higher order thinking is not simple. It requires effort and cognitive facility. Describing this kind of thinking neurologically is limited by our narrow understanding of how the brain works. The most sophisticated methods currently used to observe the act of thinking use what is called *activation imaging* which depicts the effects of various sensory stimuli on brain activity (Small, 2009). Observing the patterns in neural activity while participants engage in cognitive tasks allows researchers to draw conclusions about how the brain works (Small, 2009). Activation imaging can only reveal surface level information about how the brain responds to sensory stimuli.

Higher order thinking is a cognitively complex phenomenon that defies neurological explanation.

These limitations in our ability to scientifically define higher order thinking do not lessen its value (Greengard, 2009). The value of higher order thinking is admittedly debatable, and in fact the basis of this entire discussion rests on the degree of value that is place on higher order thinking. Even if digital technology is affecting our higher order thinking skills, is this a threatening reality?

Historically, new technologies have been met with apprehension and skepticism. Wolf and Barzillai (2009) remind their readers that,

> ...Socrates cautioned his society *against* learning to read. He believed that literacy could alter the kind of memory and probative processes required for the young to deeply pursue and internalize knowledge. He worried that the seeming permanence of writing would delude young people into thinking that they had learned the truth, when they had just begun to search for it. (p. 32)

When the printing press was invented, many feared that people would cease to exercise their memory altogether (Kosik, 2009). These predictions have arguably been realized to a certain extent. Whether or not these cognitive changes are positive or negative depends largely on what one considers to be the most vital aspects of thinking in general.

Samuel Greengard (2009) boldly states that critical thinking is a cornerstone in the western world:

> Society has long cherished the ability to think beyond the ordinary. In a world where knowledge is revered and innovation equals progress, those able to bring forth greater insight and understanding are destined to make

> their mark and blaze a trail to greater enlightenment.... Without critical thinking we create trivia.... (p.18)

Even the fact that so many are concerned about the deterioration of higher order thinking betrays its importance to individuals (Greenfield, 2009; Greengard, 2009; Hallowell, 2009; Small, 2009). Nationwide learning standards require that schools promote the development of higher order thinking skills in their curricula (*U.S. National Standards, EducationWorld.com*). Creative, strategic, reflective thinking is held in high esteem because it has allowed us to reach great heights and explore the richness of our human existence.

Higher order thinking is arguably one of the most vital cognitive skills, and its development in our students is especially crucial in this age of digital technology and overflowing information (Zawilinski, 2009; Klingberg, 2009). This may seem counterintuitive since this digital era is characterized by speed, access, and multi-tasking. Wolf and Barzillai (2009) rhetorically ask this question: "when information seems so complete, what motivation is there to go beneath and beyond it?" (p. 35). As will be expounded upon later, "the digital culture's reinforcement of rapid attentional shifts and multiple sources of distraction can short-circuit the development of the slower, more cognitively demanding comprehension processes that go into the formation of deep reading and deep thinking" (Wolf & Barzillai, 2009, p.35). The need to examine the digital media that surround us remains in spite of this trend.

Continued Relevance of Higher Order Thinking in the Digital Age

Advocacy for media education for teachers and students is currently on the rise (Buckingham, 2003; Buckingham & Burn, 2007; Hutchinson, 2007; Gee, 2003; Marsh,

2005; Potter, 2008; Prensky, 2007). Researchers and theorists are realizing the importance of allowing students to think critically about the media with which they interact (Buckingham, 2003; Buckingham & Burn, 2007; Potter, 2008; Squire, 2006). Buckingham (2003) argues that, in order for students to become competent citizens, they must be literate in the new types of communication that are permeating our modern interactions. Traditional kinds of literacy are not sufficient for the next generation (Buckingham, 2003; Buckingham & Burn, 2007; Marsh, 2005; Potter, 2008). Nonetheless, higher order thinking skills remain the central focus of even this realm of learning. Zawilinski (2009), for example, identifies several elements that are essential to interfacing with the medium of the Internet: identifying questions, finding potential sources, evaluating information, synthesizing information, critically evaluating findings, and communicating these findings. These tasks require the tools of higher order thinking such as application, analyzing, evaluating, and creating. Edward Tenner (as cited in Wolf & Barzillai, 2009) remarks, "it would be a shame if the very intellect that created...new technology was threatened by it" (p.35). In conclusion, higher order thinking remains essential even in this digital age. It is critical that we maintain our emphasis on the importance of higher order thinking especially in a time when "the wealth of communication and information" that has digitally inundated our world threatens to "overwhelm our reasoning abilities" (Greengard, 2009, p. 18).

Assuming, then, that higher order thinking is valuable, the significance of this study lies in its ability to reveal the positive or negative effect of digital gaming on higher order thinking skills, as demonstrated through reading comprehension ability. Before establishing the connection between higher order thinking and reading comprehension, it

is fitting to review the established effects of digital gaming on cognitive functions in general.

Cognitive Functions and Neuroplasticity

To begin, a pivotal assumption must be exposed: in asking the question, "*How* are digital games affecting cognitive functions?" it is assumed that digital games *can* have an effect on our brains. Although this may seem obvious, it is vital to remember this unique feature of thinking, namely, that it can be altered. Through the processes of assimilation and accommodation, whether in the formal environment of the classroom or in the informal environment of the home, new experiences change the way people think. This psychological capacity is what is otherwise known as *learning*.

Neuroscientists call this ability of the human brain to form new connections and pathways *neuroplasticity* (Willis, 2009; Wolf & Barzillai, 2009). Because our brains are able to assimilate and accommodate new sensory input, we are able to learn. This process of organizing, strengthening, and altering the brain's neural connections occurs underneath the surface of sensory inputs that we receive (Wolf & Barzillai, 2009). As our brains interpret a myriad of sounds, smells, sights, tastes, and textures, they are able to adjust and adapt through neuroplasticity, allowing learning to take place.

All cognitive functions (or thinking) are made possible by our ability to attend to sensory stimuli, interpret those stimuli through a network of firing neurons, and store those interpretations and connections as memories to be retrieved later (Gabrieli, 2009). Our ability to think hinges on our ability to remember, and we remember that to which we give our attention (Klingberg, 2009). Theoretically, this means that whatever we spend our time attending to will inevitably shape our memories and, hence, our thinking.

In this case, if a student gives his/her attention to video games, theoretically the student's thinking would be affected by this sensory experience due to neuroplasticity.

There are several kinds of memory that are at work in the human brain. Working memory is of particular significance to this discussion. Working memory is the kind of memory that allows us to manipulate information immediately (Restak, 2009). It is our working memory that permits us to do what is known as multi-tasking. This concept has also been called "fast-switching" (Hallowell, 2009), "continuous partial attention" (Small, 2009), and "divided attention" (Greenfield, 2009, p.70).

This ability of the working memory to multi-task is enhanced by playing video games (Greenfield, 2009; Restak, 2009; Schmidt & Vandewater, 2008). In addition to this, video game playing promotes the enhancement of other cognitive functions such as: information processing (Greengard, 2009), reaction time (Restak, 2009; Small, 2009), sensory motor skills (Restak, 2009; Small, 2009), visual-spatial skills (Greenfield, 2009), and visual attention (Restak, 2009; Schmidt & Vandewater, 2009). Because these cognitive skills can be observed and measured more easily than higher order thinking skills can be observed and measured, scientists, as cited above, have been able to draw conclusive evidence – primarily by comparing the level of skill in one of these areas before engaging in video game play and after extensive video game play – that affirms a strong correlation between these skills and video gaming.

In summary, researchers have observed a correlative relationship between video gaming and the improvement of speedy thinking (Greenfield, 2009; Hallowell, 2009). Video gamers are better able to divide their attention and perform many different tasks at the same time (Greenfield, 2009). They are also able to decode information and react to it

more quickly (Restak, 2009). However, the question that many researchers are asking is this: can individuals think deeply when they are thinking so quickly? (Greenfield, 2009; Greengard, 2009; Wolf & Barzillai, 2009).

Neuroscientists have confirmed that, although the possibilities for the enhancement of brain functioning are astounding, neuroplasticity does not allow for limitless change to occur in the brain (Dockterman, 2009; Klingberg, 2009). There is only so much that we can think about and remember; this notion is called *limited attention* (Hallowell, 2009; Restak, 2009).

Dr. Patricia Greenfield (2009) aptly notes that "every medium develops some cognitive skills at the expense of others...." (p.71). It is her belief that, in the case of digital technologies like video games, "the cost seems to be deep processing" (Greenfield, 2009, p.71). This hypothesis remains largely unsubstantiated; however, many others like Dr. Greenfield are positing similar theories (Greengard, 2009; Hallowell, 2009; Small, 2009; Wolf & Barzillai, 2009).

While many are suspicious of the negative effects that video gaming may have on higher order thinking, some others have suggested that video games may be able to enhance deep thinking by making the less demanding cognitive functions (e.g. information decoding processes) more efficient (Greengard, 2009; Wolf & Barzillai, 2009). In contrast, psychologist Dr. Edward Hallowell (2009) argues that "you can't go in depth fast". He states that, in order for multitasking to occur easily, one cannot delve deeply into any one of the given tasks; one must remain at a surface level in one's thinking.

This theory – that higher order thinking is deteriorating as fast thinking is forced to develop due to the pressures of digital technologies like video games – is based on the previously established reality that our brains are limited in their capacity to perform cognitive functions (Restak, 2009). In the case of video games, it is theoretically possible that they are developing the cognitive function of multi-tasking at the expense of "deep processing", otherwise known as higher order thinking (Greenfield, 2009).

Video Games and Learning

Thus far, the discussion has focused on how digital video games may affect the specific cognitive skill of higher order thinking. It is important to note that educators have been curious about how digital video games affect learning in general for several decades. In order to test the viability of learning through video games, game designers began to create educational video games in the 1970s (Etuk, 2008). As this kind of gaming has developed over the years it has been defined as "video game-based learning," "educational gaming," and "edutainment" (Etuk, 2008, para. 4). However, it is currently and most commonly referred to as Digital Game-Based Learning (DGBL) (Prensky, 2007). There are a variety of interfaces through which these digital games are played including: computer programs, Internet sites, and video game consoles. In the school context, computer programs are the most commonly used interface (Rice, 2007).

There exists a continuum of game types, ranging from non-electronic games, to video games, to simulations. The use of non-electronic games in education has long been accepted (DiPietro et al., 2007). Electronic games, more commonly known as video games, make up the next category of games. What is more difficult to distinguish is the difference between video games and simulations. In most cases simulations are referred

to as video games that possess a greater resemblance to reality (DiPietro et al., 2007; Rice 2007; Squire, 2006). Simulations are currently more commonly used in universities and in military schools (DiPietro et al., 2007; Squire, 2006). The kinds of games referred to here are video games, as distinguishable from non-electronic games and simulations.

DGBL and Academic Achievement: Research

As game designers developed video games with explicit educational content and skills, theorists and researchers began to take an interest in studying the effects of these video games on students' academic achievement. Several studies have been conducted on the relationship between digital game-based learning and academic achievement (Din & Calao, 2001; DiPietro et al., 2007; Ferdig, 2007; Rosas et al., 2003; Warren et al., 2008).

In a study, Din and Calao (2001) assess whether or not a real correlation exists between DGBL and academic success, particularly with kindergarten age students. The 47 participating schoolchildren ages 5 to 6 were split into two groups. The students from both groups each received a pretest and posttest: the experimental group of 24 students engaged in a Sony PlayStation (Lightspan) educational game; the control group of 23 students remained in their regular learning environment. The overall results of this study display a positive correlation between DGBL and academic achievement; however, in isolation, these results cannot defend a causal relationship between DGBL and academic success.

Another study was conducted on first and second grade students to examine how video games affect learning, motivation, and classroom dynamics (Rosas et al., 2003). A total of 1274 students from lower socioeconomic backgrounds in 6 different Santiago, Chile schools (urban and rural) were assigned either to the experimental group, or to one

of the two control groups. The experimental group used video game software designed to teach the content that the control groups would learn using traditional instructional methods. Using pretests and posttests, surveys of teachers and students, and classroom observations, the authors compared the three groups. The results of this study indicate that students were highly motivated to play the educational video games, which led to greater motivation in learning and attending school in general. The authors acknowledge, however, that additional research on the effects of video games on learning is needed.

In a third study, conducted by Warren, Dondlinger, and Barab (2008), the effectiveness of video games in supporting students in their writing skills was observed and analyzed, especially the kinds of writing skills required for standardized testing. The first of the two 4th grade classes was immersed in the *Anytown* multi-user virtual environment while the comparison group remained in a regular classroom. The students were assessed on numerous occasions using a pretest-posttest comparison design. Ultimately, this study supports the idea that students are motivated by the narrative element in digital games, which allows for a higher degree of much needed practice with writing. The narrative element, prevalent in video games, helps to "[contextualize] their writing activities in meaningful ways," (p.120) thus motivating them to practice and develop their writing skills.

So far, researchers are not convinced that a causal relationship can be claimed between the use of educational video games and academic success (Din & Calao, 2001). In these studies, there are apparent increases in students' content learning after the use of certain educational video games (Din & Calao, 2001; Rosas et al., 2003; Warren et al., 2008). However, more research is undoubtedly needed in order to confirm more than a

correlation between the two (Din & Calao, 2001; Ferdig, 2007; Rosas et al., 2003; Warren et al., 2008). As this research continues, theorists also contribute to the conversation, gathering data and forming hypotheses regarding this potential correlation between video games and academic achievement.

Video Games and Pedagogy: Theories

Theorists have posited that video games are attractive to game players by virtue of their design. In other words, this digital medium contains certain features that make it effective in engaging players in whatever the game might be. Squire (2006) names two of these elements: interactivity and agency. Interactivity refers to the reciprocal responsiveness between game and player (Gee, 2007). Agency refers to the authorship given to game players (Squire, 2006; Gee, 2007). With each interaction the player creates a narrative (Liu & Lin, 2009; Potter, 2008). Narrative is a third component of video game design that is strongly associated with effective engagement of players (Liu & Lin, 2009; Potter, 2008).

Video games are also defined by their ability to immerse players in the game world (DiPietro et al., 2007; Hutchinson, 2007; Squire, 2006). Players' experiences in these virtual worlds are action-oriented as evidenced by the inherent presence of challenges, rules, procedures, and problem-solving (DiPietro et al., 2007; Rosas et al., 2003; Squire, 2006). These essential features – interactivity, agency, narrative, and immersion – make video games popular, and their degree of popularity hinges on the quality and complexity of these essential features (Gee, 2003; Squire, 2006).

Not only have theorists been keenly attentive to what makes video games popular, but also to what makes video games learnable. Both of these components – popularity

and learnability - affect the success of video games (DiPietro et al., 2007; Etuk, 2008; Gee, 2003). In his book, *What Video Games Have to Teach Us about Learning and Literacy,* James Gee (2003) claims that good pedagogy is inherent in the design of good video games. Furthermore, he concludes that good pedagogy in video games can inform the pedagogy of our classrooms by its example. The elements that allow video games to be "learnable" can be generalized to the classroom context in order to enhance classroom learning. Since its publication, Gee's book has been cited in almost every journal article that considers the relationship between video games and education. His theory permeates the literature on DGBL and has been discussed in further detail by countless theorists since its publication (Compton-Lilly, 2007; DiPietro et al., 2007; Etuk, 2008; Kebritchi, 2008; Prensky, 2007; Rice, 2007; Squire, 2006; Warren et al., 2008;).

Video Game Pedagogy and Reading Pedagogy

Compton-Lilly builds on Gee's theory about excellence in video game pedagogy by providing a theoretical tie to classroom pedagogy. In an article on reading instruction, Compton-Lilly (2007) asserts that the learning principles in video games that Gee (2004) highlights are synonymous to the excellent learning principles of reading. Compton-Lilly compares a sampling of Gee's thirty-six principles of video game learning to principles of learning how to read. Several of these principles are outlined below.

Psychosocial Moratorium Principle

This principle refers to the suspension of all real-world consequences, and it focuses on the importance of a risk-free learning environment. In the world of video games, students need not worry about real-world consequences because their actions exist in a virtual realm. It is appropriate to note here that video games may, through the

psychosocial moratorium principle, perpetuate a false sense of security for students who might attempt to generalize video experience to real world experience. In the case of reading, this principle challenges teachers to provide a safe context in the classroom wherein students can confidently test their ideas and take risks (Compton-Lilly, 2007).

Identity Principle

Real-world identities are merged with those identities in the virtual worlds of both books and video games. As readers and players enter into the narratives of their respective mediums, they take on new identities. These identities, Compton-Lilly (2007) asserts, must be fostered as game-players and students explore their identities and develop character.

Practice Principle

As the name suggests, this principle notes the value of meaningful, repeated practice in order to promote learning. In video games, practice is embedded in the game so as to give the repeated actions significance, therefore sustaining engagement. In the same way, it is vital for readers to remain engaged in continuous reading practice (Compton-Lilly, 2007).

Ongoing Learning Principle

Learners are always in the process of mastering content and skills. Players experience success as they master the levels in games. If the game is too easily mastered, players lose interest. The condition of ongoing learning entices and motivates players to continue to strive for better game-play. In the same way, readers should always operate within this same balance of mastery and continued learning (Compton-Lilly, 2007).

Probing Principle

This principle involves a cycle of probing, reflecting, hypothesizing, re-probing, and accepting or rethinking. Gee (2004) describes how this process occurs naturally in games as players learn to explore the video game. A similar cycle exists in reading which allows readers to read critically (Compton-Lilly, 2007). Since reading is meaning-making activity, readers make attempts to decode and understand what they are reading (probe), think deeply about what the words might mean together (reflecting), draw potential conclusions about the text's meaning (hypothesize), and thoughtfully consider the soundness of their conclusions through a process of analysis and evaluation (re-probing and accepting or rethinking) (Compton-Lilly, 2007). This process of reading comprehension – reflecting on texts, analyzing their content, evaluating one's conclusions, and creating meaning – is parallel to the cognitive processes characteristic of higher order thinking.

Subset Principle and Incremental Principle

These combined principles support the idea that learning occurs in chunks. Game levels build on each other, and appropriate difficulty must be present in order for effective learning to occur. The equivalent in reading is the varied levels of text difficulty introduced to readers as they progress. Vygostky first illustrated this idea with his concept of a Zone of Proximal Development (ZPD): learners need a balance of difficulty and support in order for learning to take place (Woolfolk, 2007). In both video games and reading, skills build on each other and are continually exercised in a variety of ways in order to support the game-player and reader respectively (Compton-Lilly, 2007).

Explicit Information On-demand and Just-in-time Principle

Video games provide explicit information such as directions, hints, and feedback exactly when needed. This principle is linked to the idea that we must teach the reader not the text. Being sensitive to what kind of support and direct instruction students need as they develop is vital to their improvement (Compton-Lilly, 2007).

Conclusion

Compton-Lilly (2007) recognizes that the ideas about effective reading pedagogy discussed in this article are not new. She concedes that there are limits to the usefulness of DGBL. However, video games are recognized as a viable means of teaching students to read since the principles by which they operate are similar to those of excellent reading pedagogy (Compton-Lilly, 2007; Gee, 2003).

Video Games and Schools

Even if the effectiveness of DGBL were to be firmly established, there are several barriers to its integration into schools. Rice (2007) lists factors such as: teacher perceptions, graphics' sophistication, hardware availability, and lack of alignment to standards. Throughout the literature, however, the two most oft mentioned barriers are: 1) teacher awareness and attitudes; 2) unsatisfactory alignment of video game design with the school pedagogies.

Lack of teacher education in the possibilities and challenges of DGBL is one of the most commonly cited barriers to its inclusion in school curriculums (Becker, 2007; Compton-Lilly, 2007; Ferdig, 2007; Liu & Lin, 2009; Mullen, 2008; Potter, 2008; Rice, 2007; Squire, 2006). In the past, video games have only been used in the context of entertainment and leisure. Therefore, Rice (2007) states, most educators dismiss any

notion that video games could have the potential for more academic uses. The previously cited study conducted by Rosas et al. (2003) notes the largely uninformed status of teachers with regards to the possibilities and challenges of DGBL.

Becker (2007), Rice (2007), and Squire (2006) agree that educators should seek a more critical understanding of DGBL whether or not they adopt it in their classrooms. However, Squire is not as enthusiastic about persuading teachers to embrace DGBL. He asserts that there is a great deal of incongruence between the learning context of educational video games and the traditional classroom of which teachers should be wary. In his article, he discusses the importance of considering DGBL as a "designed experience" (p. 19) that promotes powerful ideologies and identities for learners. Squire (2006) argues that learners acquire particular ways of doing and being through their engagement in video gaming; many others are supporting this assertion (Shaffer, 2006; Gee, 2007; Buckingham, 2003; Potter, 2008). Rice simply notes the lack of teacher awareness; Becker approaches the issue from a primarily positive view of DGBL; Squire (2006) is much more hesitant to advocate for the positive effects that DGBL may have on learning.

The second most frequently cited barrier is the lack of quality in educational game features and pedagogy. The quality and complexity of the interactions afforded in these immersive game-worlds vary widely. Hence some games are more popular than others (Etuk, 2008; Prensky, 2006; Rice, 2007). It is apparent, for example, that the caliber of commercial games tends to be far superior to that of educational video games (Prensky, 2006; Rice, 2007). Rice notes that this has caused students to be less enthusiastic about playing educational video games. Since the consumer audience is not currently as wide

for educational video games as it is for popular commercial video games, there is a lack of money and expertise being spent on educational video games (Ferdig, 2007).

In a recent study, Kebritchi (2008) examined the kinds of instructional strategies and pedagogical foundations (if any) that are intentionally woven into game designs. Only a minority of the game designers actually provided explicit information on the pedagogical foundations of their games. Given the fact that the presence of these pedagogical foundations are an important part of the potential effectiveness of DGBL in the classroom, Kebritchi (2008) highlights the need for more intentional inclusion of these teaching principles in educational video games if they are to be used in schools.

Although conclusive evidence on the effectiveness and viability of DGBL has not yet been established, this area of research is rapidly growing in response to the need for more founded theories on the subject. In the meantime, it is widely acknowledged that educators, parents and even students should be well-versed in a critical understanding of DGBL (Becker, 2007; Gee, 2003; Kebritchi, 2008; Rice, 2007; Squire, 2006).

Conclusions on Video Games and Learning

The potential contributions to education that DGBL may be able to provide are promising. However, the reservations that many educators still have are not unfounded, and any incorporation of DGBL in the classroom should be done with careful consideration of both its positive and negative effects on learning. To date, studies on the relationship between video gaming and learning have restricted the video game type to the category of DGBL which explicitly intends to teach specific content or skills. As previously noted, these studies affirm a positive correlation between DGBL and learning while calling for additional research to yield more substantial conclusions.

With regard to video games in general, theorists have posited that any excellent video game – as measured by the quality and complexity of their interactivity, agency, narrative, and ability to immerse the player – is inherently capable of teaching simply by virtue of its design. If any excellent video game is theoretically capable of teaching students effectively, should we not be concerned about what these video games – educational and popular – are teaching students? Because of the gap in this area of the research, this study addresses all kind of video games, instead of those that have an intentionally educational purpose.

Research, thus far, has also treated learning as a general category instead of focusing on specific areas of learning. In this study, the specific area of higher order thinking will be isolated in an effort to yield more focused results. Admittedly, this is still a sizeable area of learning and one that is not easily measured. Therefore, reading comprehension will serve as an indicator for higher order thinking skills. To legitimize the relationship between higher order thinking and reading comprehension, the following research and support is outlined.

Deep Processing Linked to Deep Reading

What Greenfield (2009) refers to as "deep processing" includes what is known as higher order thinking, and, more specifically, it includes what Wolf and Barzillai have termed "deep reading" (2009). Deep reading consists of "...the array of sophisticated processes that propel comprehension and that include inferential and deductive reasoning, analogical skills, critical analysis, reflection, and insight" (Wolf & Barzillai, 2009, p.32). This list of skills inherent in deep reading contains essential components of higher order thinking in general. Many of the cognitive skills required for deep reading can be

categorized as functions of higher order thinking. Research has established a strong correlation, for example, between reading skills and reflection skills (Kagan, as cited in Greenfield, 2009). Reading has proven to be an essential element in the development of critical thinking (Terenzini, as cited in Greenfield, 2009). Greenfield (2009) affirms that "reading...develops imagination, induction, reflection, and critical thinking as well as vocabulary" (p.71). Reflection is especially vital to any form of higher order thinking, and the written word lends itself to allowing time for this reflection to take place (Greenfield, 2009). Video games, on the other hand, reward impulsivity; they penalize their players if they pause to reflect (Greenfield, 2009). It is the more "time-consuming cognitive processes" that are "at the heart of what we call 'deep reading'" (Wolf & Barzillai, 2009, p.32).

Summary

Video games, like other technologies that people have created, are causing ripples in the way that we think and learn. Millions have engaged in exploring this digital medium for pleasure and for education. In the last 40 years, countless educational video games have been created, and educators and researchers alike continue to seek answers about its potential effectiveness in the classroom. At the same time, many are wondering how and to what extent this and other digital media are altering the way that we think, especially our ability to think critically and reflectively. Although several cognitive benefits have been associated with playing video games, there are cognitive costs that necessarily exist in conjunction with them. These costs are not definitely known, but many theorize that higher order thinking is one that merits consideration. This kind of thinking is especially needed in an age of abounding sensory input and information that

would otherwise overwhelm and control us without the distinctly human capacity to reflect on and critically evaluate it (Greengard, 2009; Wolf & Barzillai, 2009).

Using reading comprehension – or "deep reading" – as an indicator of higher order thinking, this study aims to detect any correlation that might exist between video game play and higher order thinking.

Chapter III

METHODS AND PROCEDURES

Introduction

In this study, a total of three surveys and two reading comprehension tests were used to glean information about students' reading and gaming attitudes, habits, and performance. The three surveys, administered to all 72 students in the population of the study, provided self-reported data about the students' attitudes and habits. The two reading comprehension tests, administered to only 10 students selected from the population of the study, provided quantitative data on the students' reading comprehension skills. Scale and nominal data from these surveys and tests were entered into the SPSS program. A series of correlational tests were performed in a discovery-oriented way in order to find statistically significant correlations between reading comprehension and digital gaming. The scope and quantity of data obtained using each of these five instruments provides substantial information about the patterns of engagement and perception for each student with regard to reading and digital game play.

Setting and Population

The participants in this study were four males and six females, grade 5 students from a rural middle school in New York. The principal investigator selected the population and setting for this study based on the relationships that were formed between the grade 5 students and teachers and the investigator during a student teaching experience. This allowed the study to be conducted with a sufficiently large group of

students who could flexibly participate in the various components of the study. All 72 students in grade 5 in this identified rural middle school in New York participated in the first three surveys: the *Reading Attitudes Survey,* the *Motivation to Read Profile,* and the *Digital Games Survey.* These surveys did not require formal permission from parents because they were classified by the grade 5 teachers as surveys that may well have been administered by classroom teachers in the regular course of teaching. Due to absences on the days these surveys were administered, some students were not able to participate in the surveys. Of the 72 students in grade 5, 61 students participated in the *Digital Games Survey* (84.7%) and 70 students participated in the *Reading Attitudes Survey* and *Motivation to Read Profile* (97.2%).

Of the 61 students who participated in the *Digital Games Survey,* 10 participated in the *Woodcock Reading Mastery-Revised;* 7 of 10 came from the highest reading group and 3 of the 10 came from the middle-ability reading groups. There were four males (40%) and six females (60%) in this group of 10 students. The methods used to select these 10 students is outlined in the next section of this chapter.

Data Collection

This study was conducted during the fall and spring semesters of the 2009-2010 school year. The three surveys were administered during the fall semester, and the two reading comprehension tests were administered during the spring semester.

In mid-October 2009, the investigator drafted a *Digital Games Survey* (see Appendix C) in order to begin the process of assessing the students' gaming habits, attitudes toward gaming, and relative success in playing video games. The *Digital Games Survey* was revised based on feedback from experts in the field of digital media and from

professors with experience in survey design. The completed survey was then administered to the 61 students in grade 5 who were present on the day it was given (around late-October). At the beginning of each English Language Arts (ELA) class period on that day, the purpose and content of the *Digital Games Survey* was clarified for the students. The students were given as much time as they needed to complete the survey in class. This survey required students to provide answers to several kinds of questions including: descriptive/short answer questions about their gaming habits; multiple-choice questions about their attitudes, history and context of their play, and their relative success with digital games; two questions that used a Likert scale to assess their attitude toward and success with digital gaming.

In late November, two surveys on reading attitudes and habits were administered to the 70 grade 5 students in attendance. Again, the purpose and content of the surveys were explained to the students at the beginning of each ELA class period, and the students were given ample time to complete both of the surveys consecutively. These surveys provided background information on each student's reading comprehension abilities and attitudes. The *Reading Attitudes Survey* used a Likert scale and included a series of 20 questions about the respondent's reading patterns and his/her attitude toward reading in a variety of contexts (see Appendix D). The *Motivation to Read Profile* asked a series of 20 multiple-choice questions about the respondent's perceptions of his/her own reading abilities as well as his/her opinions about reading (see Appendix E). The *Reading Attitude Survey* was taken from a K-12 school resource site for reading (LCSS, n.d.). The *Motivation to Read Profile* was taken from an instructional resource from the National Reading Research Center (Gambrell, 1995).

After collecting information from the surveys during the fall semester, the investigator proceeded to collect test results for reading comprehension during the spring semester. The first of the two tests was a Practice ELA Test from the *Grade 5 NYS Reading Test*. This was independently administered by the classroom teacher during the regular school day as a part of her instruction. Only the final scores for the 10 selected students were obtained for this test, and the results are merely supplemental to the second test: *Woodcock Reading Mastery Tests – Revised (WRMT-R)* (Woodcock, 1987).

A limited number of students participated in the WRMT-R because the investigator possessed a limited amount of time and testing materials. Additional testing would have required further permissions and an undesirable disturbance of the regular course of classroom learning. From the 61 students who completed all three surveys, 10 students were chosen to participate in the WRMT-R. In order to determine which students would participate in the WRMT-R, the investigator used the students' answers on the *Digital Games Survey* to categorize each participant according to five levels of gaming interest and capability: low, low-middle, middle, middle-high, and high. These categorizations were approximated by the investigator based on: number of hours played (Q1), whether or not the student considered himself/herself a good game player (Q2), years of play (Q5), whether or not it was the student's favorite activity (Q7), how much they liked to play (Q8), and how successful they were at video gaming (Q9). Based on trends in their answers, each student was placed into one of the five categories of gaming interest and capability.

Two students from each category were chosen to participate in the study, one girl and one boy. Due to scheduling restrictions, the majority of the students who were

available to participate in the study came from the highest reading group (70%). Since the students from the highest reading group were not evenly distributed throughout the levels of gaming interest, three students from other reading groups were asked to participate based on their position in the categories of gaming interest. A letter crafted by the investigator and revised by expert advisors was mailed to the parents/guardians of each student who was asked to participate in order to obtain the necessary permissions (see Appendix B). Permission was granted to 70% of the original students designated to participate. Two of the refusals were due to students' unwillingness to participate, and the third permission slip was not returned due to illness. Three additional students were selected to replace these three. The final ratio of boys to girls was 6:4 due to the alternations made through the permission process.

Only the last two sections of the WRMT-R – Analogies and Passage Comprehension – were administered to the designated students. The other sections did not pertain directly to reading comprehension, and were, therefore, inconsequential to the purposes of this study. The investigator administered these two portions of the test individually to each of the 10 selected students in a separate, quiet location in the school building. Students were excused from class or study hall in order to participate and returned promptly to their respective classes after testing was completed. Directions and one or two practice questions were provided for each student at the start of their testing, and students were given the option of a verbal synopsis of their general performance by the investigator immediately after finishing the test. All parents were provided with a copy of their child's results on the WRMT-R upon request.

Instrument

The scientifically tested instrument used in this study was the *Woodcock Reading Mastery Test-Revised (WRMT-R)* (Woodcock, 1987). This test is standardized and has been revised (1987) from its original 1973 version. Strict procedures were followed in order to establish the norms used in this test.

Validity and Reliability

The validity and reliability of the Woodcock Reading Mastery Test-Revised have been established through standardization and internal consistency, as reported in the test administered manual.

Summary of Data

The three subtest scores from the WRMT-R (analogies raw score, passage comprehension raw score, and passage comprehension standard score) and ELA Practice Test score were entered into SPSS first. The multiple choice question data from the *Digital Games Survey* were entered as scale and nominal data. Data from each of the reading surveys – *Motivation to Read* and *Reading Profile* – were then entered according to their relevance to reading comprehension.

Pearson correlation tests were run on various combinations of data sets based on subhypotheses (outlined in Chapter IV) about potentially significant correlations. Other practically important correlations that emerged from further correlation testing were also considered.

Ethics

All necessary precautions were taken with regards to protecting the individuals who participated in this study. The grade 5 teachers were consulted before administering

the three surveys to the students. Prior to administering the WRMT-R, a research proposal was brought before the Institutional Review Board at Houghton College (see Appendix A). The research proposal satisfied the concerns of the IRB and permission was granted to proceed with the research. A copy of the IRB proposal was given to the grade 5 ELA teacher and to the middle school principal in order to receive permission from them for administration of the WRMT-R. The grade 5 ELA teacher was in frequent communication with the investigator during all portions of the data collection. The middle school principal was also included in all major correspondence and decision-making with regard to the study. Permissions were also sought from parents/guardians before any testing proceeded. Results were kept confidential.

Because only 10 of the 72 students in grade 5 were selected to participate in the *Woodcock Reading Mastery-Revised*, a clear explanation was given to each individual who participated. Before proceeding with individual testing, the investigator fully delineated the purpose and outcome of the testing to the individual student being tested in order to prevent any misunderstandings or discomfort. It was particularly emphasized that the students were not chosen based on their reading ability and that their personal results would not be shared except in the context of aggregate data in the study. This information was detailed to each parent in the letter of permission, and to each child, one-on-one, prior to their testing.

Chapter IV

ANALYSIS OF DATA

Introduction

This study was initiated for the purpose of analyzing the relationship between students' gaming habits and their higher order thinking skills. The more specific hypothesis addressed here is whether or not there exists a negative correlation between digital gaming and reading comprehension. The three surveys – *Reading Profile, Motivation to Read,* and *Digital Gaming Survey* – along with the results of the *Woodcock Reading Mastery Test-Revised* and the *ELA Practice Test* were used to collect data on the areas of digital gaming and reading comprehension for each participant.

The questions from the multiple choice portion of the *Digital Gaming Survey* were entered into SPSS as scale and nominal data depending on the nature of each question. Only a selection of questions from the *Reading Profile* and *Motivation to Read* surveys were entered into SPSS, and all of these questions were entered as scale data. The questions from each of these surveys were chosen based on their relevance to the hypothesis. Although all of the questions related to the students' reading habits and skills, some did not specifically address their reading comprehension or reading attitudes that might affect their reading comprehension. Therefore, only 10 of the 20 possible questions from the *Reading Profile* survey and 5 of the 20 possible questions from the *Motivation to Read* survey were analyzed.

Raw scores for the *ELA Practice Test* were entered as scale data. Raw scores for the *Analogies* portion of the WRMT-R were entered as scale data. The standard score could not be calculated for the *Analogies* portion because scoring required additional sections to be administered which were not. Both the raw and standard scores for the passage comprehension portion were entered as scale data. The raw score for passage comprehension was included in order to more accurately compare to the analogies portion if necessary. All 30 pieces of data are outlined in Table 1.

Table 1

Question Descriptions

Question Number	Question Description
1	Gender
2	WRMT-R Analogy Raw Score
3	WRMT-R Passage Comprehension Standard Score
4	WRMT-R Passage Comprehension Raw Score
5	ELA Practice Test Raw Score
6	Hours of video game play
7	Self-perceived video game ability
8	Individual vs. group playing preference
9	Number of family members who play
10	Number of years played
11	Achievement of highest level in a game (Y/N)
12	Video gaming as a favorite activity (Y/N)
13	Affinity for video games
14	Self-perceived degree of success with video games
15	Playing video games in school (Y/N)
16	Affinity for reading
17	Self-perceived reading ability compared to friends
18	Self-perceived ability to decode challenging words
19	Self-perceived ability to understanding what is read
20	Self-perceived effectiveness as a reader
21	Degree of importance placed on reading
22	Self-perceived ability to answer teacher's questions about reading
23	Degree of reading enjoyment ("fun factor")
24	Ease of reading
25	Affinity for group discussions about reading
26	Enjoy reading for fun (Y/N)
27	Likelihood of engaging in reading instead of playing video games
28	Self-perceived ability to respond to teachers questions about reading
29	Affinity for book learning
30	Affinity for reading class

Items from these five data sources, including 30 scale and nominal variables, were analyzed using the Pearson product-moment correlation test. The results of this analysis provided statistical data on the correlative relationship between all possible parings of data.

Analysis

Before analyzing the overall results of the bivariate correlation test, secondary hypotheses were drafted in anticipation of possible correlations. No single correlation could substantiate the main hypothesis that a negative correlation exists between digital gaming and higher order thinking as demonstrated by reading comprehension. Therefore, these secondary hypotheses were used to probe the variety of correlations that could possibly speak to the main hypothesis. The three secondary hypotheses investigated sought to determine if correlations existed between: 1) the number of hours the student played video games (Q6) and the student's self-perceived effectiveness as a reader (Q20); 2) the student's level of understanding of what they read (Q19) and their quantity of and affinity for video game play (combined Q6, Q10, Q13, and Q14); 3) the student's passage comprehension score (CumReading) (combined Q2, Q3, Q4, and Q5) and their quantity of and affinity for video game play (combined Q6, Q10, Q13, and Q14). (See Table 1 for a summary of question descriptions.)

In order to consolidate similar variables, the following four variables were condensed into a single variable representing the student's overall quantity of and affinity for video game play (CumVG): the number of hours played (Q6), the number of years played (Q10), their affinity for game play (Q13), and their success with video games (Q14). Similarly, a composite score was created to encompass the overall passage

comprehension level for each student (CumReading) which included: the analogies raw score (Q2), the passage comprehension standard score (Q3), the passage comprehension raw score (Q4), and the ELA Practice Test score (Q5).

The correlation between the number of hours the student played video games (Q6) and the student's self-perceived effectiveness as a reader (Q20) (0.167) was not statistically significant (see Table 2).

Table 2

Correlation between Hours of Video Game Play and Effectiveness as a Reader

		Quality Reader
Hours of Game Play	Pearson Correlation	**.167**
	Sig. (2-tailed)	.667
	N	9

The students' level of understanding of what they read and their quantity of and affinity for video game play (CumVG) also did not correlate significantly (0.221) (see Table 3).

Table 3

Correlation between Level of Understanding and Cumulative Video Game Score (CumVG)

		CumVG
Understanding	Pearson Correlation	**.221**
	Sig. (2-tailed)	.599
	N	8

Thirdly, the correlation between the students' passage comprehension score (CumReading) and their quantity of and affinity for video game play (CumVG) (-0.012) was not significant (see Table 4).

Table 4

Correlation between Cumulative Video Game Score and Cumulative Reading Score

		CumReading
CumVG	Pearson Correlation	**-.012**
	Sig. (2-tailed)	.977
	N	8

Collectively, the analysis of the correlations between these secondary hypotheses did not support the original hypothesis.

Interpretation

There are several possible explanations for why these correlation tests did not yield statistically significant results to support the original hypothesis. The first two factors pertain to the population of the study. The majority of the participants (70%) were taken from the highest achieving reading class, and are, therefore, not typical students. A more diverse participant population would have represented the general population more accurately, and may have generated results to support the negative correlation between video game play and higher order thinking skills. The small sample size was also a contributing factor that undoubtedly skewed the results. Since greater accuracy can be achieved with more participants, a larger sample size may have drastically altered the outcomes of the correlation tests.

The second aspect that likely affected these results pertains to limitations in the tools used to measure higher order thinking skills and video game play. Higher order thinking is a complex cognitive function that includes numerous sub-skills, including (but not limited to) reflection, analysis, creation, critical thinking, problem-solving, inductive reasoning, and synthesis (Greenfield, 2009; Greengard, 2009; Wolf & Barzillai, 2009).

Reading comprehension is only one of the many ways that higher order thinking is used and stimulated. Therefore, the WRMT-R is limited in its ability to probe the higher order thinking skills that each student possesses. Furthermore, the passage comprehension portion of the WRMT-R is not an all-inclusive measurement of reading comprehension itself. Reading comprehension can activate multiple higher order thinking skills including (but not limited to) reflection, analogical skills, critical thinking, and inferential thinking (Wolf & Barzillai, 2009). However, with any given reading passage, not all higher order thinking skills will be utilized. Measuring each student's reading comprehension ability using multiple assessments would have more accurately reflected their cognitive abilities and may have yielded more statistically significant results in support of the original hypothesis.

Similarly, further assessment of each student's gaming attitude and habits may have yielded more statistically significant results. The survey provided useful insight into each student's self-perceived habits and self-reported attitudes. However, it did not provide objective data on their gaming habits. A more objective measurement of each student's gaming habits would have more accurately assessed the status of their video game play. These results may have produced more statistically significant correlations between higher order thinking skills and video gaming.

Additional Correlations: Beyond the Main Hypothesis

After running the bivariate correlation tests and determining that the hypothesized correlations were not statistically significant, all correlations that were statistically significant were examined for practiced relevance. A few of these correlations merit further discussion.

Decoding

Two statistically significant correlations exist in relation to students' ability to decode challenging vocabulary. In the first correlation, the number of hours the student played video games (Q6) and their self-perceived ability to decode unfamiliar words (Q18) (.763) was significant at the .05 level (see Table 5). This suggests that the greater the number of hours the student plays video games, the less confident the student is in decoding unfamiliar words.

Table 5

Correlation between Hours of Video Game Play and Confidence in Decoding

Correlations

		Hours of Game Play
DecodeRecode	Pearson Correlation	**-.763(*)**
	Sig. (2-tailed)	.017
	N	9

* Correlation is significant at the 0.05 level (2-tailed).

Similarly, the correlation between the students' affinity for playing video games (Q13) and the students' self-perceived ability to decode unfamiliar words (Q18) (.754) was significant at the .05 level (see Table 6).

Table 6

Correlation between Confidence in Decoding and Affinity for Video Game Play

Correlations

		Like to Play
DecodeRecode	Pearson Correlation	**-.754(*)**
	Sig. (2-tailed)	.012
	N	10

* Correlation is significant at the 0.05 level (2-tailed).

According to this second correlation, the student's affinity for playing video games is inversely proportional to their confidence in decoding unfamiliar words. These two significant correlations suggest that students who are prone to frequent video game play are less confident in their ability to decode unfamiliar words.

Research suggests that digital technologies are developing cognitive functions that demand fast-switching between tasks rather than concentrated effort on tasks that require more time (Greenfield, 2009; Greengard, 2009; Hallowell, 2009; Small, 2009; Wolf & Barzillai, 2009). Decoding unfamiliar words is arguably a task that requires more time and effort. Students who reported that they "almost never figure out" words that are unfamiliar, therefore, may not be spending the necessary amount of time needed to decode challenging words. These two correlations suggest that the students who may not be spending the amount of time needed to decode difficult words are also the students who are spending more time playing video games. Those students who spend more time playing video games are potentially skipping over challenging words in an effort to accomplish the task with speed rather than thoroughly taking time to decode the unfamiliar word.

Importance of Reading

A second set of statistically significant correlations exists in relation to the level of importance that each student places on reading. The importance that the students placed on reading (Q21) significantly correlated to their affinity for game play (Q13)(0.641) at the .05 level, the number of years that the student played video games (Q10)(-.746) at the .05 level, and their self-perceived degree of success with video games (Q14)(.855) at the .01 level (see Table 7).

Table 7

Correlations pertaining to the Importance of Reading

		Like to Play	Years of play	Successful
Importance of Rdg	Pearson Correlation	**.641(*)**	**-.746(*)**	**.855(**)**
	Sig. (2-tailed)	.046	.021	.002
	N	10	9	10

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

These correlations suggest that the higher the students' perceived gaming ability, the greater importance they place on reading. This result may be due to the high achieving status of the majority of the students who participated in the study. The students' overall outlook on their own abilities and the importance they place on education are typically greater for higher achieving students.

Accurate Self-perception

A majority of the data used in this study was self-reported. Therefore, the accuracy of the data depends on how accurately each participant was able to reflect his/her abilities and attitudes. The correlation between the students' passage comprehension standard score (Q3) and their self-perceived reading ability compared to their friends (Q17)(.781) was significant at the .01 level. (see Table 8)

Table 8

Correlation between Passage Comprehension and Comparative Reading Ability

		Rdg Compared to Friends
Passage Comp Standard Score	Pearson Correlation	**.781(**)**
	Sig. (2-tailed)	.008
	N	10

** Correlation is significant at the 0.01 level (2-tailed).

This correlation affirms the students' accurate self-perception about their relative reading ability. It also affirms the validity of the *Motivation to Read Profile* in assessing the students' relative reading ability since their self-perceived ability correlated with their actual score on the passage comprehension portion of the WRMT-R.

Conclusion

The data did not reveal a statistically significant negative correlation between reading comprehension and video game habits or attitudes. The reasons for this may be due to inherent limitations in the study including the high achieving status of 70% of the participants, the small sample size, and the restricted data on each student's video game habits and their higher order thinking skills. Nonetheless, the significant correlations related to decoding support existing theories about trends in gaming and its effect on thinking. This will be explored in the next chapter.

Chapter V

DISCUSSION AND RECOMMENDATIONS

Purpose and Procedures of the Study

The purpose of this study was to explore the potential effects of digital gaming on higher order thinking through an investigation of possible correlations between digital gaming and reading comprehension. A total of 3 surveys – *Digital Gaming Survey, Reading Profile,* and *Motivation to Read* – and 2 tests – *Woodcock Reading Master Test-Revised* and *Grade 5 ELA Practice Test* – were administered to 10 grade 5 students in order to gather necessary data on each student's gaming habits and reading comprehension abilities. The WRMT-R was conducted orally in a one-on-one setting. The other 4 instruments were conducted in a whole class context and in written form. These surveys and tests were administered intermittently over the course of 4 months (October 2009 to January 2010) in order to minimize disturbance. From these 5 instruments, 30 pieces of data were chosen based on relevance to the main hypothesis and entered into the SPSS computer program as scale and nominal data. A series of Pearson correlation tests were performed between various pairs of data based on predetermined sub-hypotheses intended to probe possible correlations between digital gaming habits and reading comprehension skills. After analyzing the statistical results of the secondary hypotheses, other noteworthy correlations that emerged from the comprehensive correlation table were briefly examined.

Summary and Implications of Findings

The Pearson correlation coefficients for the pairs of data that corresponded to each of the 3 secondary hypotheses were not statistically significant. Therefore, correlations between the students' digital gaming habits and their reading comprehension abilities were not substantiated by the data collected. However, these results may have been skewed by existing limitations in the study's population and the instruments used to identify trends each participants' digital gaming habits and reading comprehension skills.

The population of the study was relatively small and consisted primarily of high achieving students (70%). A larger more diverse population would have more accurately represented the general population of elementary students, and may have altered the statistical correlations significantly. Secondly, the investigation of each student's gaming habits was only assessed through self-reported data. A systematic, objective analysis of the students' gaming habits would have provided more factual records of their gaming tendencies. Lastly, the WRMT-R and *ELA Practice Test* are limited in their assessment of each student's reading comprehension abilities. Moreover, reading comprehension is only one manifestation of an individual's ability to perform higher order thinking skills. A more thorough, comprehensive assessment of each student's reading comprehension abilities or, more broadly, their higher order thinking skills would have more accurately represented their capabilities, thereby potentially affecting the correlational results.

Undoubtedly, the original hypothesis cannot be abandoned based on the results of this study. Further research on the relationship between digital gaming and reading comprehension is needed in order to dismiss or verify possible correlations between the two.

Recommendations for Future Study and Practice

Through the process of conducting this study, gaps and shortcoming in this and other research on the relationship between digital gaming and higher order thinking became apparent. In an effort to inform and spur on further research and discussion on this topic, potential directions for future research and practice are offered here.

Future Study

The most challenging issue in designing this study was finding an appropriate measure of higher order thinking skills in elementary age students. Because of the complexity and depth of higher order thinking, accurate assessments of this cognitive skill are rare, and those that exist are often intended for adults and require extensive training and funding in order for them to be effectively administered (T. Dawson, personal correspondence, November 23, 2009).

The assessment of Higher Order Thinking (HOT) skills is especially difficult since skill knowledge is not something that a person "has" but something that a person must *recreate* each time it is needed or desired (Fischer, 2009). Dr. Kurt W. Fischer (2009) posits that the development of learning pathways in people can be compared to a web, not a ladder. Dr. Fischer's (2009) *Dynamic Skills Theory* affirms that, although the pathways that learners take toward the mastery of various cognitive skills are diverse, they have a strong tendency to move through similar areas and, because of this, there can be a common ruler with which to measure cognitive development. Based on Dr. Fischer's *Dynamic Skills Theory*, Dr. Theo Dawson (2009) created a developmental assessment system called the *Lectical Assessment System*. Dr. Dawson is also the founder

of a testing initiative called the *DiscoTest Initiative* that seeks to design assessments that gauge individuals' level of cognitive engagement with subject matter (Fischer, 2009).

The work of Dr. Fischer and Dr. Dawson focuses on the enhancement of critical thinking skills, reflective judgment, and what Dr. Fischer terms "robust learning that can be used across situations" (Fischer, 2009). The development of authentic assessments for higher order thinking skills is critical to further study on the relationship between digital gaming and higher order thinking. Furthermore, these assessments would provide support for teachers who desire to foster the development higher order thinking skills in their students. Dr. Fischer and Dr. Dawson's research and theoretical frameworks provide helpful foundations for researchers and teachers alike who are seeking to promote the development of higher order thinking skills in students. The use of their instruments should be considered in future research.

Since there are numerous sub-skills included in higher order thinking, isolating particular sub-skills and comparing the effect of digital gaming on each one might yield significant results in a future study. Research suggests that digital gaming may enhance particular higher order thinking skills including problem-solving and decision-making while impairing other higher order thinking skills such as reflective judgment, creativity, and inferential reasoning (Greengard, 2009; Wolf & Barzillai, 2009). Examining these sub-skills in isolation may bring to light underlying dynamics of the correlation between digital gaming and higher order thinking that broad analysis would fail to reveal.

Similarly, particular digital games could be categorized according to the skill-sets that are exercised or required for effective game play. This would require extensive analysis of game content and design. Comparing the effects of a range of game-types on

higher order thinking may expose the elements of digital games that most strongly influence either the enhancement or degradation of higher order thinking skills. Since most digital games for elementary age children are not designed with an expressed intent to exercise particular skill-sets, careful profiling and analysis of the identified digital games will likely be necessary (Kebritchi, 2008).

Specific modifications of this study that could be implemented in future research include: (a) gathering and analyzing data from larger sample sizes; (b) gathering objective data on students' gaming habits instead of using only self-reported data; (c) comparing a range of age groups from a similar context or school; and/or (d) conducting a longitudinal study on the relationship between digital gaming and higher order thinking. Although the focus of this study was digital gaming, research that examines how the use of other digital media (e.g. Internet, texting, e-mail, etc.) effects higher order thinking is also needed (Zawilinksi, 2009).

Future Practice

As research continues to accumulate on this topic, it is vital for educators to critically evaluate current research and discussions related to the effects of digital media on higher order thinking. Teacher must remain open to and aware of the positive and negative effects that digital media might have on the cognitive functions of students. Learning about particular programs for DGBL is one means of assessing the viability of using digital media to teach cognitive skills. A wide range of materials for technology supported instruction have been produced in recent years including *FAST Math*, *Thinking Reader*, and *TimeLiner* (Dockterman, 2009). The use of the Internet as a context for reading comprehension exercise has also been investigated (Zawilinski, 2009). Exploring

and critically evaluating these programs and initiatives that promote the use of technology for learning purposes is crucial to incorporating any new technologies into the classroom. Critiquing current research and seeking reliable program sources allows educators to make informed decisions about their pedagogy and practice related to digital media in their classrooms and schools.

Not only should educators remain informed, but they should also continue to promote the kind of "robust learning" that Dr. Fischer (2009) endorses. Whether or not digital media negatively or positively affect higher order thinking skills, educators must continue to foster the development of these complex cognitive abilities in students.

Conclusions

In this study, the relationship between digital gaming and higher order thinking was explored. Although no conclusive evidence was found in this present study to support this hypothesis, further study is necessary in order to more fully explore the complexities of the relationship between digital gaming – and other digital media – and higher order thinking skills including reading comprehension.

Cognitive capacity is limited, and every medium promotes the development of particular cognitive skills at the detriment of others (Greenfield, 2009; Schmidt & Vandewater, 2008). Video gaming and other digital media have been found to enhance such cognitive functions as attention capacity, attention deployment, divided attention, fast processing, reaction time, and memory (Greenfield, 2009; Restak, 2009; Schmidt & Vandewater, 2008; Small, 2009). However, the question remains whether or not it can enhance higher order thinking skills such as critical thinking, imagination, reflection,

analysis, synthesis, and creativity (Greenfield, 2009; Greengard, 2009; Wolf & Barzillai, 2009).

Educators and researchers alike are seeking to use new media technologies as learning tools (Dockterman, 2009; Fischer, 2009; Zawilinksi, 2009). However, there is limited evidence that these digital media are any more effective that traditional forms of instruction (Schmidt & Vandewater, 2008). As new media technologies continue to infiltrate the lives of students, it is imperative that educators and researchers continue to critically evaluate these new media and their effect on how students learn to think.

APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD APPLICATION AND APPROVAL LETTER

Houghton College

Application for IRB Review and Approval of Research Involving Human Participants

I. Identifying information: Please complete this form and submit it only electronically to cathy.freytag@houghton.edu. Allow two to three weeks for review/action, dated from e-mail acknowledgement of acceptance.

Project Director's Name: **Emma Fitzgerald** E-mail:**emma.fitzgerald@houghton.edu**
Date: **December 6, 2009**

Academic Department: **Education**

Faculty Advisor (if the project director is a student): **Dr. Cathy Freytag**

Start Date: **Jan. 9, 2010** End Date: **Feb. 9, 2010**

Explain Context of Research or Reason for Re-Review (if previously approved):
This research will be conducted at Perry Middle School in Mrs. Johnson's 5th grade ELA class.

Funding agency or research sponsor, if any: *n/a*

Title of Research: *The Effects of Digital Gaming on Higher Order Thinking*

List all researchers on this project, if more than those mentioned above: *n/a*

II. Research Description:

a. Statement of the problem and purpose:
The purpose of this research is to explore the relationship between students' gaming habits and their higher order thinking skills. It is not intended that this research will draw causational conclusions, but simply observe any correlations between these two elements in students. This research is being done as a part of a Senior Honors Project.

b. Research question:
What is the correlation between students' gaming habits and their reading comprehension skills (requiring higher order thinking)?

c. Nature of data and the collection methods:
This data will be quantitative and qualitative. I will assess 5 students' on their reading comprehension skills. The data will be collected through an individual, oral assessment called the Woodcock Reading Mastery Tests - Revised. *The*

setting and timing of the administration will be arranged with their ELA classroom teacher, Mrs. Johnson depending on each student's schedule.

d. Instruments to be used (provide title and descriptions here, but also send a hard copy for review, if not in electronic format):
Woodcock Reading Mastery Tests – Revised
http://psychcorp.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=PAa16640
The test battery is available for IRB members to review upon request. All inquiries should be directed to me (Emma Fitzgerald), or to my advisor, Cathy Freytag. (emma.fitzgerald@houghton.edu; cathy.freytag@houghton.edu)

e. Recruitment methods of participants:
All of the 5th grade students at Perry Middle School participated in a Digital Gaming Survey. From the self-reported data in this survey, I will chose 3-5 students who differ significantly in their gaming habits to participate in the Woodcock Reading Mastery Test. These students will then be asked if they would be willing to volunteer as participants in this study. Parents will be notified and given the opportunity to grant permission for their child to participate or not.

f. Participants' profile:
   a. *Age range: 10-12*
   b. *Number anticipated: 3-5*
   c. *Sex: male & female*
   d. *5th grade Perry Middle School students*

g. Describe other pertinent information:
I am familiar with all the potential participants in this study because I completed my Student Teaching experience at Perry Middle School in Shannon Johnson's 5th grade ELA classroom.

III. Research Risks: Describe in detail any stress, psychological, social, legal, economic, or physical harm that might occur to participants and the precautions you will take to hold these to a minimum. What debriefing or remediation is provided?
Because I will be selecting only 3-5 students from a group of 75, the students selected may feel singled out and, therefore, uncomfortable. In order to minimize these potential negative effects, I will be sure to clarify with each student the purpose of the assessment and the fact that they have not been chosen based on their reading abilities.

IV. Research Benefits (any risks must be outweighed by benefits):

a. Identify any benefits to participants resulting from this research:

1. *If requested, the parents of each participant may receive their child's scores on the Woodcock Reading Mastery Test as extra feedback as they develop their reading skills.*
2. *Each student will also receive a "Bee Buck". (A "Bee Buck" is a tangible reward system used at Perry Middle School to encourage positive behaviors – respect, responsibility, and safety. Each time a student is seen demonstrating one of these 3 traits, he/she receives a slip of paper called a "Bee Buck".)*
3. *Each student will also receive candy/dessert treat during the lunch period after all participating students have been assessed.*

b. Identify any benefits to humankind in general from this research:
This research will contribute to the body of literature on the effects of gaming on cognitive functions, namely, higher order thinking. As educational researchers continue to explore the impact of digital gaming on our students, it is vital to understand how it is changing how we think. The results of this research project will further our understanding of this issue.

V. Consent Form:

a. How will subjects be informed that they do not have to participate in the study, and may withdraw at any time without penalty or prejudice? How will legally effective informed consent be obtained from all participants? Attach an electronic copy of the Consent Form to be signed and any statement to read to the participant.

The parents of each participating child will receive a letter of permission that explains the research purpose and their child's potential involvement. In this letter, parents will be given the opportunity to grant their consent or refusal to let their child participate. It will be made clear in the letter that it is not a requirement, and that they have the right to exclude their child from the assessment for any reason.

b. If any active deception is necessary, justify, describe, and submit debriefing procedures. n/a

VI. Minors and Others: If minors or other vulnerable persons are involved, outline procedures to obtain their agreement (assent), in addition to the consent of their authorized representative (e.g., parent or guardian).
I will email Mrs. Johnson, the ELA classroom teacher, and give her a list of the students that I would like to participate in this study. Mrs. Johnson will pull each of those students aside during the school day and explain the intended assessment. She will ask them if they would be willing to participate, and then give me a list of the students who are willing. I will then contact parents/guardians to seek parental permission.

VII. Future Risk: How are all participants protected from the potentially harmful future use of the data collected? Describe measures planned to ensure anonymity and

confidentiality. If audio or videotapes are used, how are they stored or when are they erased?
To identify these students on their assessment, I will only use initials instead of full names. In the description of this data, I will use a consistent pseudo-name for each student.

I (we) certify that the protocol and methods of obtaining consent and preserving confidentiality as approved by the IRB will be followed during the period covered by this research project. Any significant changes will be re-submitted for re-approval prior to implementation.

Project Director: Emma Fitzgerald Emma Fitzgerald

Date: December 10, 2009

Project Advisor: Cathy E. Freytag

(The project advisor signature is required if this is primarily a student research project and signifies advisor approval.)

Date: 12/10/09

Houghton College Institutional Review Board

Memo

To: **Emma Fitzgerald, student researcher; Cathy Freytag, faculty advisor**

From: Daryl Stevenson, acting IRB Chair

CC: David Brubaker, Cathy Freytag, Brandon Hoffman, Edna Howard, Richard Stegen

Date: December 14, 2009

Re: IRB approval for senior honors research

Principal researcher's name: Emma Fitzgerald (Cathy Freytag, faculty advisor)

Title of study: The Effects of Digital Gaming on Higher Order Thinking

Type of application: Initial

Level of review: Expedited

Comments: Houghton's IRB has conferred regarding your proposal. Given your familiarity with the Perry school district, the students, and your former student teaching master teacher and setting, it appears you are ready to proceed. The IRB has no concerns about the typical issues that such projects face, such as working with minors. You have anticipated these. We wish you well as you proceed in the next few months with this Senior Honors Project.

Approval date: December 14, 2009

APPENDIX B

PARENT CONSENT LETTER

Dear Parents,

Your child has been **invited to participate in a research project** to be conducted by a Houghton College Senior at Perry Middle School. The research purpose is to *explore the relationship between students' gaming habits and their reading comprehension skills*. I, Emma Fitzgerald, will be conducting this study in order to collect necessary data for an honors project that I am working on under the supervision of Dr. Cathy Freytag, Education Department, Houghton College.

If you give permission for your child to take part in this study, I will ask your child to participate in a portion of the oral reading comprehension assessment called the *Woodcock Reading Mastery Test*. The study will take about an hour to complete.

There are **no known risks** for your child connected with participating in this research. They have not been chosen based on their reading comprehension ability, and the results of the assessment will not affect their grade in any way.

The **benefits** that you and your participating student will receive from this assessment are as follows:

1. If you wish to be mailed a copy of the results of their assessment as an additional piece of feedback on their reading comprehension, I would be more than willing to provide this for you and your child.
2. Your child will receive a "Bee Buck" for being a responsible student participant.
3. You child will also receive, as a small token of thanks, a candy/dessert treat during the lunch period after all participating students have been assessed.

This research will add to educators' growing knowledge of the effects of gaming on higher order thinking. It will further the discussion on the potential benefits and concerns related to digital gaming.

I guarantee that your child's identity will be kept **confidential** throughout this process. Only initials and pseudo-names will be used; last names will not be included. Your child's scores and responses will be used only for the purposes of my Honors Project.

Participation in this study is **voluntary**. Your child may refuse to participate or withdraw from the study at any time without penalty.

If there is anything about the study or your child's participation that is unclear to you or that you do not understand, if you have questions, or if you wish to report a research-related problem, please feel free to **contact** me (emma.fitzgerald@houghton.edu; 585-746-5302) or my supervisor, Dr. Cathy Freytag (cathy.freytag@houghton.edu) at any time.

If you have questions about your child's rights as a participant, you may contact the chair of the Institutional Review Board at Houghton College, Dr. Cathy Freytag (cathy.freytag@houghton.edu).

Please sign in the space provided on the back of this letter if you are willing to have your child participate in this study, return the form to Shannon Johnson by December 16, 2009.

Sincerely,
Emma Fitzgerald

I grant _____ (student's full name) permission to:

(Please check the appropriate boxes and sign below.)

_____ **participate** in the *Woodcock Reading Test*

_____ let his/her **scores** be shown to Perry teachers

I **would** like to receive a copy of _____'s (student's name) **unofficial assessment results**. *(Please check the appropriate box.)*

_____ Yes _____ No

Parent/Guardian Signature:

_____

Date:

_____

APPENDIX C

DIGITAL GAMES SURVEY

Digital Games Survey

Name _____

Grade\Period _____

Instructions

Please answer the following questions.

Short Answers

1) What are some of your **favorite activities** to do after school or on the weekends?

2) **List** some of the video/computer games that you like to play.

3) List some of the video/computer games that you liked to play **when you were younger.**

4) List any video/computer **game systems** that you have. (Computer, Laptop, Nintendo, PlayStation, PlayStation2, Xbox, Wii, Cellphone, Gameboy, *or other*.)

5) Do you have any rules (perhaps from your parents) that only allow you to play video/computer games for a certain amount of time, on particular days, or at particular times? If so, please briefly describe them.

Multiple Choice

Circle the correct answer for each question:

1) **Approximately** how many hours do you play video/computer games every **day**?
   - **a.** 0 hrs./day
   - **b.** ½ hr. every other day
   - **c.** 1hr./day
   - **d.** 2hrs./day
   - **e.** over 2 hrs./day

2) Do you consider yourself a good video/computer game player?

a. Yes
b. No
c. I'm an average player
d. I don't play video/computer games

3) I **prefer**...
   a. Single-player games
   b. Two-player games
   c. Multiplayer games
   d. None of the above

4) Does anyone else in your house play video/computer games?
   a. Yes
   b. No
   c. Rarely

5) How many **years** have you been playing video/computer games?
   a. 1 yr.
   b. 2-4 yrs.
   c. 5-9 years.
   d. I don't play.

6) Have you ever completed the **highest level** of a video/computer game?
   a. Yes
   b. No
   c. I don't play

   If yes, what was the **name** of the game?

   _____

7) Is video/computer gaming one of your **favorite activities**?
   a. Yes
   b. No
   c. Somewhat
   d. I don't play

8) How much do you **like to play** video/computer games? (circle your answer)

Not At All **A Little** **About Average** **Quite A Bit** **A Lot**

9) How **successful** are you at playing video/computer games? (Circle your answer)

I Don't Play **Below Average** **Average** **Above Average** **Excellent**

10) Would you like to play a video game **at school**?

a. Yes
b. No
c. Maybe

APPENDIX D

MOTIVATION TO READ PROFILE

MOTIVATION TO READ PROFILE

READING SURVEY

Name _____ Date _____

Sample #1: I am in _____.

- O 1st grade
- O 2nd grade
- O 3rd grade
- O 4th grade
- O 5th grade
- O 6th grade

Sample #2: I am a _____.

- O boy
- O girl

---

1. My friends think I am _____.

   - O a very good reader
   - O a good reader
   - O an OK reader
   - O a poor reader

---

2. Reading a book is something I like to do.

   - O Never
   - O Not very often
   - O Sometimes
   - O Often

---

3. I read _____.

   - O not as well as my friends
   - O about the same as my friends
   - O a little better than my friends
   - O a lot better than my friends

---

4. My best friends think reading is _____.

- O really fun
- O fun
- O OK to do
- O no fun at all

5. When I come to a word I don't know, I can _____.

- O almost always figure it out
- O sometimes figure it out
- O almost never figure it out
- O never figure it out

6. I tell my friends about good books I read.

- O I never do this.
- O I almost never do this.
- O I do this some of the time.
- O I do this a lot.

7. When I am reading by myself, I understand _____.

- O almost everything I read
- O some of what I read
- O almost none of what I read
- O none of what I read

8. People who read a lot are _____.

- O very interesting
- O interesting
- O not very interesting
- O boring

9. I am _____ .

- O a poor reader
- O an OK reader
- O a good reader
- O a very good reader

10. I think libraries are _____ .

- O a great place to spend time
- O an interesting place to spend time
- O an OK place to spend time
- O a boring place to spend time

11. I worry about what other kids think about my reading _____ .

- O every day
- O almost every day
- O once in a while
- O never

12. Knowing how to read well is _____ .

- O not very important
- O sort of important
- O important
- O very important

13. When my teacher asks me a question about what I have read, I _____ .

- O can never think of an answer
- O have trouble thinking of an answer
- O sometimes think of an answer
- O always think of an answer

14. I think reading is _____ .

- O a boring way to spend time
- O an OK way to spend time
- O an interesting way to spend time
- O a great way to spend time

15. Reading is _____ .

- O very easy for me
- O kind of easy for me
- O kind of hard for me
- O very hard for me

16. When I grow up I will spend _____ .

- O none of my time reading
- O very little of my time reading
- O some of my time reading
- O a lot of my time reading

17. When I am in a group talking about stories, I _____ .

- O almost never talk about my ideas
- O sometimes talk about my ideas
- O almost always talk about my ideas
- O always talk about my ideas

18. I would like for my teacher to read books out loud to the class _____ .

- O every day
- O almost every day
- O once in a while
- O never

19. When I read out loud I am a _____ .

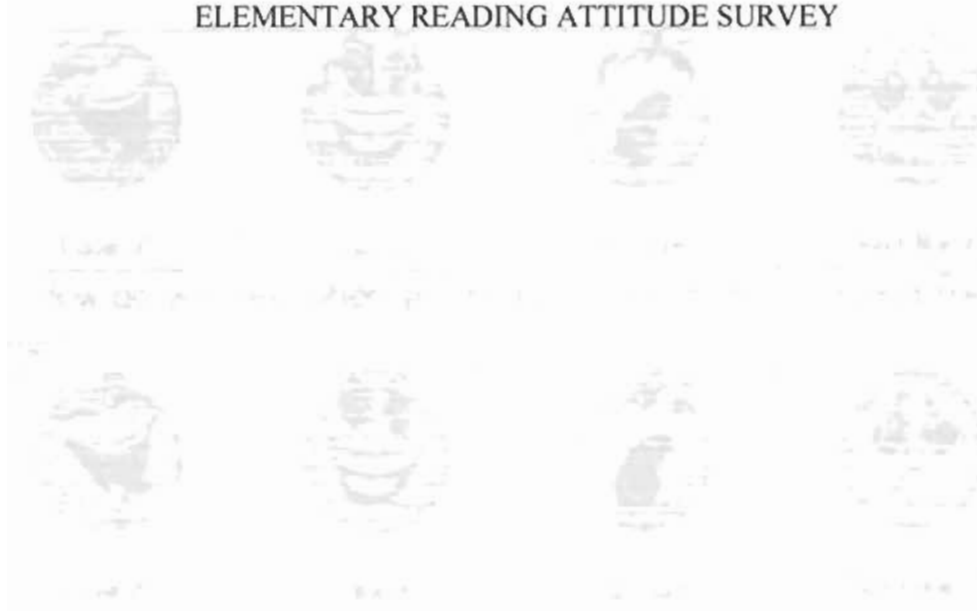
- O poor reader
- O OK reader
- O good reader
- O very good reader

20. When someone gives me a book for a present, I feel _____ .

- O very happy
- O sort of happy
- O sort of unhappy
- O unhappy

APPENDIX E

ELEMENTARY READING ATTITUDE SURVEY



ELEMENTARY READING ATTITUDE SURVEY

Student_____ Grade_____

1. How do you feel when you read a book on a rainy Saturday?			
			
Love it!	Like it.	Ho Hum..	Don't like it!
2. How do you feel when you read a book in school during free time?			
			
Love it!	Like it.	Ho Hum..	Don't like it!
3. How do you feel about reading for fun at home?			
			
Love it!	Like it.	Ho Hum..	Don't like it!
4. How do you feel about getting a book for a present?			
			
Love it!	Like it.	Ho Hum..	Don't like it!

5. How do you feel about spending free time reading?

 Love it!	 Like it.	 Ho Hum_	 Don't like it!

6. How do you feel about starting a new book?

 Love it!	 Like it.	 Ho Hum_	 Don't like it!

7. How do you feel about reading during summer vacation?

 Love it!	 Like it.	 Ho Hum_	 Don't like it!

8. How do you feel about reading instead of playing?

 Love it!	 Like it.	 Ho Hum_	 Don't like it!

9. How do you feel about going to a bookstore?			
 Love it!	 Like it.	 Ho Hum...	 Don't like it!
10. How do you feel about reading different kinds of books?			
 Love it!	 Like it.	 Ho Hum...	 Don't like it!
11. How do you feel when the teacher asks you questions about what you read?			
 Love it!	 Like it.	 Ho Hum...	 Don't like it!
12. How do you feel about doing reading workbook pages and worksheets?			
 Love it!	 Like it.	 Ho Hum...	 Don't like it!

13. How do you feel about reading in school?


Love it!


Like it.


Ho Hum...


Don't like it!

14. How do you feel about reading your school books?


Love it!


Like it.


Ho Hum...


Don't like it!

15. How do you feel about learning from a book?


Love it!

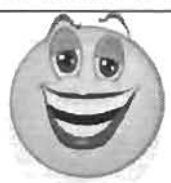

Like it.


Ho Hum...


Don't like it!

16. How do you feel when it's time for reading class?


Love it!


Like it.


Ho Hum...


Don't like it!

17. How do you feel about the stories you read in reading class?


Love it!


Like it.


Ho Hum...


Don't like it!

18. How do you feel when you read out loud in class?


Love it!


Like it.


Ho Hum...


Don't like it!

19. How do you feel about using a dictionary?


Love it!


Like it.


Ho Hum...


Don't like it!

20. How do you feel about taking a reading test?


Love it!


Like it.


Ho Hum...


Don't like it!

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